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J. C. Branner

NOTES

ON

AMERICAN LAND SHELLS

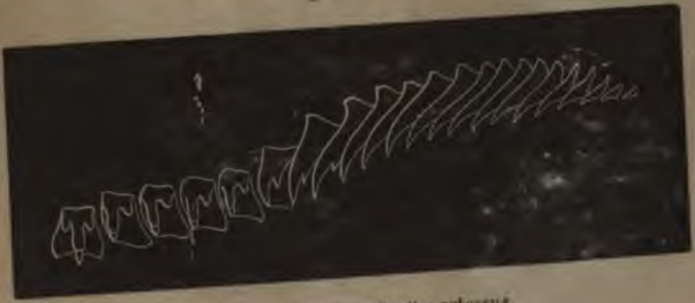
AND OTHER

MISCELLANEOUS CONCHOLOGICAL CONTRIBUTIONS.

VOL. II. PART III.

BY

W. G. BINNEY.



Lingual dentition of *Zonites arboreus.*

BURLINGTON, N. J.
PRINTED FOR THE AUTHOR.
JUNE, 1875.

594.8 B615 v.2 pt.3

LELAND·STANFORD·JVNIOR·VNIVERSITY

[Extracted from the Proceedings of the Academy of Natural Sciences of Philadelphia, April 27, 1875.]

ON THE JAW AND LINGUAL MEMBRANE OF NORTH AMERICAN TERRESTRIAL PULMONATA.

BY W. G. BINNEY.

In his work on the "Terrestrial Air-breathing Mollusks of the United States," my father paid great attention to the jaws and lingual membranes, figuring those of all the species which he could obtain. In continuing my father's labors on the same subject, I have described and figured those of many other species. Thus, in a certain sense, it may be said that a great deal is known of these organs in our land shells. Unfortunately, however, these figures and descriptions have become of comparatively little value now that the study of this subject has assumed such importance. They do not give in sufficient detail the character of the individual teeth, however correct an idea they may give of the general arrangement of the teeth upon the membrane. I have, therefore, been induced to review the whole subject, and present it in a manner which will be of value as throwing light upon classification.

The following pages contain the result of my re-examination of the lingual membranes collected by me during the last thirty years. I regret that the collection is not more perfect, but there seems little chance of my making it more so, especially as to the rarer and more inaccessible species. I have decided, therefore, to publish at this time what material I have.

Before commencing my description, I will give some general remarks on the organs treated of in my paper, and on their value for the purpose of classification, and on the bibliography of the subject.

GENERAL REMARKS.

As many of my readers are quite unfamiliar with the subject, especially most of those who have so largely contributed specimens for examination, I will describe in detail the position of the organs and the method adopted for their study.

On holding up against the light an individual of *Helix thyroides* in one hand, and offering to him with the other some food (a piece of carrot is always acceptable), one can readily see with the naked

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Bn. Zool.

eye the two organs here treated of. Above the external opening of the mouth, through the transparent tissue of the head, is seen a small, arched, reddish, free instrument, which appears to rise and fall as if used in cutting off morsels of food. This is the jaw.

On the floor of the mouth is the lingual membrane, occupying about the position of the human tongue. Its color is too nearly the same as that of the head to afford any strong contrast, but, with close attention, it will be detected by its glistening silvery appearance, as it works backward and forward.

The use of the tongue seems to be to rasp the food and also to force it back into the œsophagus.

More detailed description, fully illustrated by figures, of the position of these two organs, will be found in the chapters on Special Anatomy in the first volume of the "Terrestrial Air-breathing Mollusks of the United States."

METHOD OF EXTRACTION.

On opening the head of *Helix thyroides* from above, one readily notices at the extreme anterior part, close against the outer integument, a prominent oval body. This is called the buccal mass. It is easily cut away from the animal, and will be found to contain both jaw and lingual membrane. They can be removed by fine scissors or knives from the buccal mass in the larger species, but in the smaller species, the method usually employed is putting the whole buccal mass in a watch crystal full of a strong solution of caustic potash. Allowing it to remain for several hours, the potash will destroy all of the buccal mass, and leave the jaw and lingual membrane perfectly clean and ready for examination. They remain attached, if the solution is not too strong, showing a connection between the two. They must first be well rinsed in clean water, in another watch crystal, before examination. Another more expeditious process is to place the whole buccal mass in a test-tube, with the solution of potash, and boil it for a few seconds over a spirit lamp. Pouring the contents of the test-tube into a watch crystal, the lingual membrane attached to the jaw will be readily seen by a pocket lens. If the species be very small, as *Paluta striatella* for instance, its whole body may be thrown into the solution. Still more minute species, as *Zonites milium* for instance, may be treated in this way: crush the whole shell between two glass slides, wash away the particles of the broken shell in a few drops of water, still keeping the body of the animal on the slide; when clean, drop on it the caustic potash and boil it by holding the slide itself over the spirit lamp.

On Mounting.

For the purpose of examination, the jaw and lingual membrane may be simply mounted in water and covered with thin glass. One must be sure to spread out the lingual membrane, not have its upper side down, and it will be well to cut it transversely in several places, as the teeth are beautifully shown, and often stand detached, on the edges of the cut.

For preservation for future study I hesitate to recommend any process, as I know of none which has been tried for a sufficiently long time. I have myself lost many specimens by imperfect mounting. Canada balsam, formerly used, ruins the membrane by rendering it too transparent. The glycerine mounting fluids, now in use, certainly preserve a membrane for several years, but they have not been tried many years.

On the Jaw.

The jaw and lingual membrane, having been mounted, must now be examined under the microscope.

The jaw will be found to vary greatly in its characters in the different genera. It is either in one single piece (pl. XVI., fig. 1); in one single piece with an accessory quadrate piece attached to its upper margin; or in separate, detached pieces, free on their lower edges, usually soldered together into one single piece above (pl. XVI., fig. 13). It differs also in being with (pl. XVI., fig. 3), or without (fig. 6) a median beak-like projection to its cutting edge; also in its ends being more or less acuminated; but still more by the presence or absence of striæ or rib-like processes on its anterior surface. When present, the ribs are found in every degree of development, passing quite across the jaw and denticulating one or both margins (pl. XVI., fig. 8), or only developed on the lower portion of the jaw, and crenellating the lower margin. The ribs are often almost obsolete, or represented by wrinkles or coarse striæ. They are present on the anterior surface of the jaw only, or on both anterior and posterior surfaces. They are distant, narrow, stout, few (fig. 8); or crowded, broad, stout, and numerous (fig. 14). Their number is within certain limits inconstant in the same species. They sometimes are very broad, and seem like separate plates soldered to the anterior surface of the jaw, or to be formed by a folding of the jaw upon itself (fig. 12). When this appearance of folding into plates is given, it will generally be found that the plait-like sections are actually separated by distinct, but delicate ribs. When this form of ribs is found, they are either vertical or inclined obliquely towards the median line of the jaw. Sometimes this last arrangement is developed to such a degree that the delicate ribs meet before reaching the bottom of the jaw, and a triangular compartment is left at the upper centre of the jaw, its base being upward (fig. p.). This form of jaw is usually thin and membranous.

When the jaw is striated and not ribbed, the striæ are vertical, or they converge towards the median line (fig. p.). There are often transverse striæ also, and transverse lines of re-enforcement (pl. XVI., fig. 3).

The upper margin of the jaw is often extended into a stout membranous attachment, apparently of the same material and consistency as the jaw itself, and showing the same continuity of structure by the striæ of the jaw extending into it without interruption. This is not the accessory quadrate plate mentioned above.

The jaw is found in every degree of consistency, from very thick to quite membranous and almost transparent.

The cutting margin of the jaw is smooth, crenellated, or denticulated. It is simply concave, or furnished with a more or less developed beak-like median projection.

In shape the jaw ranges from scarcely arcuate, long, low, to horseshoe-shaped, short, high.

It will be seen below that these peculiarities of the jaw, taken in connection with the characters of the lingual membrane, appear to furnish reliable characters for classification.

ON CLASSIFICATION.

The characters of the jaw, combined with those of the lingual membrane, furnish reliable bases of classification. They have been considered of various weight by different writers. I here propose to treat them as guides only to the greater division of the Pulmonata.[1] In grouping the various genera it will be necessary to include *all*, both American and foreign to America, in order to properly appreciate the value of this grouping.

Taking, therefore, the whole series of known terrestrial Pulmonata, the first grand division is based on the presence or absence of a jaw. Of the former are the following: *Testacella*,[2] *Daudebardia*,[3] *Streptaxis*,[4] *Rhytida*,[5] *Diplomphalus*,[6] *Strebelia?*[7] *Glandina*,[8] *Petenia?*[9] *Spiraxis?*[10] *Streptostyla*,[11] *Ravenia?*[12] *Strepstostele*,[13] *Cœliaxis?*[14] *Gonospira*,[15] *Gibbus?*[16] *Ennea*.[17]

All the above have aculeate marginal teeth; the lateral teeth are always absent; the centrals in some of the genera.

The following genera have quadrate marginal teeth: *Onchidium*,[18] *Onchidella*,[19] *Peronia*,[20] *Buchanania?*[21]

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[1] I must not be understood to propose a system of classification. I merely place the genera into certain groups, independent of their divisions into families.

[2] Heynemann, Malak. Blatt. X., pl. II., fig. 5.

[3] Goldfuss verh. Naturh. Vereins der preuss. Rheinl. und Westphalens, 13th year, 1856, pl. VI., fig. *c.* c^{1}.

[4] Heynemann, Malak. Blatt. XV., pl. IV., fig. 2.

[5] Semper, Nachr. der deut. Malak. Gesellschaft II., 102.

[6] Fischer and Crosse, Journ. de Conch. XXI., 21, pl. III., fig. 8.

[7] Jaw and dentition unknown

[8] See this paper.

[9] Jaw and dentition not actually known.

[10] Jaw and dentition not actually known; as restricted, the genus may be more correctly placed near *Stenogyra*.

[11] Fischer and Crosse, Moll. Mex., p. 16, pl. IV., fig. 2.

[12] Jaw and dentition not actually known.

[13] Heynemann, Nachr. mal. Gesel. I. 20,,177, fig. 5.

[14] Jaw and dentition not actually known.

[15] Bland and Binney, Amer. Journ. Conch. V. 37, pl. XI. fig. 1, photographed.

[16] No doubt like the last.

[17] Heynemann, Nach. mal. Gesel. I. 20, 177, pl. XX., figs. 3, 4.

[18] Bland and Binney, Ann. Lyc. N. H. of N. Y. X., p. 340, pl. XVI., figs. 3–5.

[19] Heynemann, Malak. Blatt. X., pl. III., fig. 13.

[20] Quoy, Voy. de l'Astrolabe, pl. XII.

[21] Jaw and lingual unknown.

The second grand division contains those genera having a jaw. In this division also we find some genera with aculeate, and some with quadrate, marginal teeth.

Of the former are: *Limax*,[1] *Ibycus*,[2] *Parmacella*,[3] *Tennentia*,[4] *Mariella*?[5] *Parmarion*,[6] *Dendrolimax*,[7] *Phosphorax*?[8] *Urocyclus*?[9] [I know nothing of the position of *Othelosoma*, *Aspidorus*, and other problematical genera.] *Vitrina*,[10] *Vitrinoidea*,[11] *Vitrinopsis*,[12] *Nanina*,[13] and all the genera now recognized in its disentegration, *Stenopus*,[14] *Vitrinoconus*,[15] *Macrocyclis*,[16] *Zonites*.[17]

The following genera have quadrate marginal teeth. They may be readily grouped by the character of their jaw, which is either in one single piece, in one single piece with an accessory upper quadrate piece, or in numerous pieces.

Those whose jaw is in one single piece may again be subdivided into several groups based on the absence, presence, and peculiarities of the ribs on their jaw. This division, however, is unsatisfactory, as these characters are not always well marked.

(*a*) Jaw without ribs: *Philomycus*,[18] *Parmella*?[19] *Oopelta*,[20] *Anaderus*,[21] *Sagda*,[22] *Patula*,[23] *Polymita*,[24] *Hemitrochus*,[25] *Helicodiscus*.[26]

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[1] See this paper.
[2] Heynemann, Malak. Blatt. X. 142, pl. I., fig. 3.
[3] Semper, Phil. Archipell. 90.
[4] Semper, l. c. 1, pl. VI., fig. 17.
[5] Ib. 12.
[6] Ib. 9, pl. VI., fig. 16.
[7] Heynemann, Malak. Blatt. XV., pl. I., fig. 1.
[8] Jaw and tongue not known.
[9] Heynemann, Malak. Blatt. 1866, 70, pl. XI., as *Parmarion flavescens*.
[10] See this paper.
[11] Semper, l. c. 85, pl. IX., fig. 33.
[12] Ibid. 86, pl. XI., fig. 26.
[13] Ibid.
[14] Bland, Ann. Lyc. N. H. of N. Y., VIII., 158, fig.
[15] Semper, 1 c., 91, pl. XI., fig. 27.
[16] See this paper.
[17] See this paper.
[18] See this paper.
[19] Jaw and lingual dentition unknown.
[20] Heynemann, Malk. Blatt. XIV., pl. I., 2.
[21] Heynemann, Malk. Blatt. X., 138, pl. I., fig. 1.
[22] Bland and Binney, Am. Journ. Conch. VI., 177.
[23] See this paper.
[24] Bland and Binney, Ann. Lyc. N. H. of N. Y., X., 341, pl. XVI., fig. 1.
[25] See this paper.
[26] See this paper.

Acavus, *Corilla*, *Caryodes*, *Panda*, *Labyrinthus*, *Caracollus*,[1] *Leucochroa*,[2] *Cysticopsis?*[3] *Plagioptycha*,[4] *Leptoloma*,[5] *Anostoma*,[6] *Anostomella?*[7] *Tomigerus?* *Boysia?* *Plectostoma?* *Hypselostoma?*[8] *Achatinella*,[9] *Clausilia*,[10] *Stenogyra*,[11] *Strophia*,[12] *Buliminus*,[13] *Balea*,[14] *Pupa*,[15] *Vertigo*,[16] *Ferussacia*,[17] *Cæcilianella*,[18] *Geostilbia?* *Azeca?* *Tornatella?*[19] *Zospeum?*[20] *Holospira*,[21] *Eucalodium*[22] *Cœlocentrum*,[23] *Lithotis*,[24] *Rhodea*, *Megaspira*,[25] *Limicolaria*,[26] but one species has a ribbed jaw, *Achatina*,[27] *Pseudachatina?* *Perideris?* *Columna?*[28] *Bulimus* as now constituted has various forms of jaw.

(*b*) Jaw with decided stout ribs: *Arion*, *Ariolimax*, *Prophysaon*, *Pallifera*, *Veronicella*, *Binneia*, *Hemphillia*, *Helix*,[29] *Geomolacus*,[30] *Letournexia*,[31] *Peltella*,[32] *Xanthonyx*,[33] *Simpulopsus*,[34] *Pfeif-*

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[1] See Semper, l. c. No doubt other genera of disintegrated *Helix* will be found to be grouped here. I propose at present to remove from *Helix* all the species not having ribs upon their jaw.

[2] Bland and Binney, Ann. Lyc. Nat. Hist. of N. Y., X., 220.

[3] Bland and Binney, Ann. Lyc. N. H. of N. Y., IX.

[4] Proc. Ac. Nat. Sc. Phila. 1874, 56.

[5] Ibid. 58.

[6] Journ. de Conch., XIX., 261, pl. XI., fig. 4.

[7] Jaw and dentition unknown.

[8] Jaw and dentition unknown.

[9] Bland and Binney, Ann. Cyc. N. H. of N. Y., X., 335, pl. XV., figs. 6, 7.

[10] Troschel, Moquin-Tandon, Lehmann, etc.

[11] See this paper.

[12] See this paper.

[13] But some species have ribs. See Moquin-Tandon, Lehmann, etc.

[14] Moquin-Tandon, Moll. Fr., pl. XXV., fig. 6.

[15] See this paper.

[16] See this paper.

[17] See this paper.

[18] See this paper.

[19] Unknown.

[20] Heynemann, Mal. Bl. X., pl. III., fig. 14. Jaw unknown.

[21] See this paper.

[22] See Crosse and Fischer, Journ. de Conch. 1870, pl. V., fig. 1.

[23] Jaw and dentition unknown.

[24] Binney, Proc. Phila. Ac. Nat. Sc. 1874, pl. V., fig. 3.

[25] Jaw and dentition unknown.

[26] Bland and Binney, Amer. Jour. Conch., VII., 181.

[27] Von Martens, ed. 2, p. 201.

[28] Jaw and dentition unknown.

[29] See this paper.

[30] Bland and Binney, Ann. of Lyc. of N. H. of N. Y., X., 309, fig.

[31] Bourgignat, Moll. nouv. et lit. VII. 201, pl. XXXIV., fig. 1–7.

[32] Jaw apparently ribbed in Férussac's figure, pl. VII. A.

[33] Fischer and Crosse, Moll. Mex., pl. IX., figs. 15, 16.

[34] Shuttleworth, Diag., No. 6, p. 147.

feria,[1] *Berendtia*,[2] and, as stated above, some species now included in *Bulimus*, *Cochlostyla*, *Buliminus*, *Limicolaria*.

(*c*) Jaw with separate, delicate ribs, usually running obliquely towards the centre: *Gæotis*,[3] *Amphibulima*,[4] *Bulimulus*, *Cylindrella*, *Macroceramus*,[5] *Pineria*,[6] *Partula*.[7]

The genera whose jaw is in one piece with an accessory quadrate piece are *Succinea*,[8] *Omalonyx*,[9] *Hyalimax*,[10] *Athoracophorus*.[11]

The genera whose jaw is in separate pieces are *Orthalicus*, *Liguus, and Punctum*.[12] I have arranged the American genera in the same manner in the following pages.

BIBLIOGRAPHY.

The principal works referred to are:—

LEIDY in Binney's Terrestrial Air-breathing Mollusks of the United States. Boston, 1851, Little & Brown. The wood-cuts of lingual membranes are misplaced in the text. See the list, vol. II. p. 358.

BINNEY and BLAND. Land and Fresh Water Shells of North America. Part I. Smithsonian Miscellaneous Contributions. Washington, 1869.

MORSE in Journal of the Portland Society of Natural History, 1864.

MOQUIN-TANDON. Histoire Naturelle des Mollusques Terrestres et Fluviatiles de la France. Paris, 1855.

FISCHER et CROSSE. Etudes sur les Mollusques Terrestres et Fluviatiles du Mexique et l'Amérique Centrale. Paris, 1874.

LEHMANN. Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern. Cassel, 1873.

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[1] Mörch, Journ. de Conch., 1865, 385.

[2] Crosse and Fischer, Journ. de Conch. 1870, pl. V., fig. 11, 12.

[3] Bland and Binney, Ann. Lyc. N. H. of N. Y., Vol. X., pl. XI., figs. 1, 5–7.

[4] Proc. Phila. Ac. N. Sc. 1874, pl. VIII., figs. 2, 5, 6. *Pellicula* is a synonym of this.

[5] See this paper.

[6] Bland and Binney, Ann. N. Y. Lyc. N. H., X., 22.

[7] Binney, Ann. Lyc. N. H. of N. Y., XI. 45.

[8] See this paper.

[9] Malak. Blatt. X., pl. IV., fig. 5, a.

[10] Fischer and Crosse, Journ. de Conch. XV., 218, pl. X., figs. 5, 7.

[11] Bergh, verh. kais. kœnig. zoolog. botan. Gesell. in Wien. XX. 844, pl. XII., fig. 2, 4, 5.

[12] See this paper.

GOLDFUSS. Verzeichniss der bis jetzt in der Rheinprovinz und Westphalen beobachteten Land- und Wasser-Mollusken, nebst kurzen Bemerbrengen über deren Zungen, Krefer, und Liebesfeile. From Verhandlungen der natushistorischen Vereins der preussischen Rheinlande und Westphalens. 13 Jahrgang. Bonn, 1856.

SEMPER Landmollusken. Reisen in Archipel der Philippinen. Wiesbaden, 1873.

HEYNEMANN. Einige Miltkeilungen über Schneckenzungen mit besenderer Beachtung der Gattung Limax. From Malakozoologischer Blätter, X. 1862.

VON MARTENS Die Heliceen von JOH. CHRIST. ALBERS. Zweite Ausgabe. Leipzig, 1860.

These are the principal works referred to. The references to shorter papers in various periodicals will easily be understood.

ON MY ILLUSTRATIONS.

I have endeavored to give a good view of the central, lateral, and marginal teeth of each species, with the transition teeth of many of the species. The portion of the membrane chosen is different in the various species of each genus or subgenus, in order that the variations in the form and development of cusps, and cutting points may be shown. Thus on pl. III. fig. 1, *b*, I have selected the part of the membrane where the marginal teeth have a very blunt cusp, while in fig. 4, *b*, they are shown much more graceful. It must constantly be borne in mind that on any one membrane the teeth vary considerably in regard to this point.

In illustrating the general arrangement of the teeth upon the lingual membrane in each genus or subgenus, I have used the woodcuts in the text prepared for my former works and papers, mostly by Mr. Morse, and a few by Dr. Leidy, prepared for my father's work. It must be remembered that these figures do not represent correctly the characters of the individual teeth.

I have also used in the text figures of the jaws of many genera and subgenera, prepared for the Land and Fresh Water Shells of North America, Part I. The jaws of the more recently described genera and subgenera I have myself drawn by camera lucida in pl. XVI.

ON THE VALUE OF THE JAW AND LINGUAL MEMBRANE FOR THE PURPOSE OF CLASSIFICATION.

It is conceded by all recent students of land shells that for the larger divisions the presence or absence of a jaw, and the aculeate or quadrate form of marginal teeth are reliable characters.

The characters of the jaw and separate teeth of the lingual membrane have also been used in various ways for grouping the genera into families, etc., and even of grouping species into genera. I refrain from any discussion of their value for such purposes, simply because I believe our material is far too limited. It seems as if I can better employ my time in patiently accumulating new facts. I can, however, venture to say that the character of the jaw and teeth seems to be more constant in some genera than in others. It appears, for instance, that in some genera the presence or absence of lateral teeth is not a generic character, though in others it is.

The same may be said of the presence or absence of side cutting points to the centrals and laterals, and the greater or less development of their side cusps; also in the bifurcation or non-bifurcation of the cutting point of aculeate marginal teeth.

It will, I believe, be proved that certain genera are constantly characterized by peculiar form of teeth, while others have a considerable range of variation. I might, perhaps, add that when the genus is numerous in species, there is a much greater chance of finding a varying dentition. If this latter proves true, we shall be obliged to concede that there are certain types of teeth which may be found among species of some of the larger genera, though some of the smaller genera are much more, if not absolutely, restricted to one single type of dentition. I do not venture any further deductions at this time.

Before closing my paper I must return thanks to my many correspondents, who have furnished me specimens for examination during many years. I have already acknowledged their kindness while originally describing the jaw and lingual membrane of each species in the American Journal of Conchology, the Annals of the Lyceum of Natural History of New York, and the Proceedings of the Academy of Natural Sciences of Philadelphia. Most of those papers[1] were published in connection with my friend, Mr. Bland, without whose aid I never could have had the material to study lingual dentition, especially in the interesting forms foreign to the United States. He has also shown great interest in the progress of the present paper.

Finally, I must acknowledge my many obligations to my young friend, Mr. A. Ten Eyck Lansing, for his most valuable assistance in the preparation of my paper. His observations of most of the lingual membranes, independent of my own, have saved me from many errors, and rendered my work much more reliable.

I will add that all the figures in the plates have been drawn by my own hand from the microscope itself, with the aid of the camera lucida.

BURLINGTON, N. J., Oct. 1874.

A complete catalogue of the species found in North America, from the extreme north to the Rio Grande and to San Diego, here follows. An account of their geographical distribution has been published by me in the Bulletin of the Museum of Comparative Zoology, vol. iii. No. 9, Cambridge, 1873.

The sign † is affixed to the name of species whose jaw and lingual membrane are unknown.

PULMONATA GEOPHILA.

OLEACINIDÆ.

†Glandina Vanuxemensis, Lea.
truncata, Gmel.
†decussata, Desh.
†Glandina bullata, Gld.
†Texasiana, Pfr.

HELICIDÆ.

VITRININÆ.

Macrocyclis Vancouverensis, Lea.
†sportella, Gld.
concava, Say.
Macrocyclis Voyana, Newc.
Duranti, Newc.

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[1] A complete list of all these papers may be had of the American Naturalist Agency, Salem, Mass.

Zonites capnodes, W. G. B.
fuliginosus, Griff.
friabilis, W. G. B.
caducus, Pfr.
lævigatus, Pfr.
demissus, Binn.
ligerus, Say.
intertextus, Binn.
†subplanus, Binn.
inornatus, Say.
sculptilis, Bland.
Elliotti, Redf.
†cerinoideus, Anth.
cellarius, Müll.
†Whitneyi, Newc.
nitidus, Müll.
arboreus, Say.
viridulus, Mke.
indentatus, Say.
limatulus, Ward.
minusculus, Binn.
milium, Morse.
Binneyanus, Morse.
ferreus, Morse.
†conspectus, Bland.

Zonites exiguus, Stimpson.
†chersinellus, Dall.
capsella, Gld.
fulvus, Drap.
†Fabricii, Beck.
Gundlachi, Pfr.
†Stearnsi, Bl.

gularis, Say.
suppressus, Say.
lasmodon, Phillips.
significans, Bland.
internus, Say.
multidentatus, Binn.
Lansingi, Bland.
Vitrina limpida, Gould.
†Angelicæ, Beck.
Vitrina Pfeifferi, Newc.
exilis, Mor.
Limax maximus, Lin.
flavus, Lin.
agrestis, Mull.
campestris, Binn.
Hewstoni, J. G. Cooper.
Ingersolli, W. G. B.

HELICINÆ.

*

Patula solitaria, Say.
strigosa, Gld.
Cooperi, W. G. B.
Hemphilli, Newc.
Idahoensis, Newc.
†Haydeni, Gabb.
alternata, Say.
Cumberlandiana, Lea.
†tenuistriata, Binn.
perspectiva, Say.
striatella, Anth.
†pauper, Mor.
†Horni, Gabb
asteriscus, Morse.
†incrustata, Pfr.
vortex, Pfr.
Hemitrochus varians, Mke.
Tebennophorus Caroliniensis, Bosc.
†Holospira Roemeri, Pfr.

Holospira Goldfussi, Pfr.
Helicodiscus lineatus, Say.
Ferussaccia subcylindrica, L.
Cæcilianella acicula, Müll.
Stenogyra decollata, Linn.
subula, Pfr.
†octonoides, Ad.
†gracillima, Pfr.
Pupa muscorum, Linn.
†Blandi, Morse.
†Hoppii, Müll.
†variolosa, Gld.
pentodon, Say.
†decora, Gld.
†corpulenta, Morse.
†Rowelli, Newc.
†Californica, Rowell.
fallax, Say.
†modica, Gld.

†**Pupa Arizonensis,** Gabb.
†**hordeacea,** Gabb.
†**armifera,** Say.
†**contracta,** Say.
rupicola, Say.
corticaria, Say.
†**pellucida,** Pfr.
†**borealis,** Mor.

Arion fuscus, Müll.
†**foliolatus,** Gld.
Ariolimax Columbianaus, Gld.
Californicus, J. G. Cooper.
Hemphilli, W. G. B.
niger, J. G. Cooper.
Andersoni, J. G. Cooper.
Prophysaon Hemphilli, Bl. and Binn.
Binneia notabilis, J. G. Cooper.
Hemphillia glandulosa, Bl. and Binn.
Pallifera dorsalis, Binn.
Wetherbyi, W. G. B.
Gonostoma Yatesi, J. G. Cooper.
Strobila labyrinthica, Say.
Hubbardi, Brown.
Polygyra auriculata, Say.
uvulifera, Shuttl.
auriformis, Bld.
†**Postelliana,** Bld.
espiloca, Rav.
†**avara,** Say.
ventrosula, Pfr.
†**Hindsi,** Pfr.
Texasiana, Moricand.
†**triodontodes,** Bld.
Mooreana, W. G. Binn.
†**tholus,** W. G. Binn.
†**hippocrepis,** Pfr.
fastigans, L. W. Say.
†**Jacksoni,** Bld.
Troostiana, Lea.
Hazardi, Bld.
†**oppilata,** Moricand.
†**Dorfeuilliana,** Lea.
†**Ariadnæ,** Pfr.
septemvolva, Say.
cereolus, Muhlf.
†**Carpenteriana,** Bld.
Febigeri, Bld.

Vertigo Gouldi, Binn.
Bollesiana, Morse.
†**milium,** Gld.
ovata, Say.[1]
ventricosa, Morse.
†**simplex,** Gld.
Strophia incana, Binn.

*

Polygyra pustula, Fér.
†**pustuloides,** Bld.
leporina, Gld.
Polygyrella polygyrella, Bld. and J. G Cooper.
Stenotrema spinosa, Lea.
†**labrosa,** Bld.
†**Edgariana,** Lea.
Edvardsi, Bld.
barbigera, Redf.
stenotrema, Fér.
hirsuta, Say.
†**maxillata,** Gld.
monodon, Rack.
germana, Gld.
Triodopsis palliata, Say.
obstricta, Say.
appressa, Say.
inflecta, Say.
Rugeli, Shuttl.
tridentata, Say.
Harfordiana, J. G. Cooper.
fallax, Say.
†**introferens,** Bld.
Hopetonensis, Shuttl.
†**vultuosa,** Gld.
loricata, Gld.
Mesodon major, Binn.
albolabris, Say.
†**divesta,** Gld.
multilineata, Say.
Pennsylvanica, Green.
Mitchelliana, Lea.
elevata, Say.
Clarki, Lea.
†**Christyi,** Bld.
exoleta, Binn.
Wheatleyi, Bld.

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[1] *V. tridentata*, Wolf, is synonymous with this.

- **Mesodon dentifera**, Binn.
  - **Roëmeri**, Pfr.
  - **Wetherbyi**, Bland.
  - **thyroides**, Say.
  - **clausa**, Say.
  - **Columbiana**, Lea.
  - **Downieana**, Bld.
  - †**Lawi**, Lewis.
  - †**jejuna**, Say.
  - **Mobiliana**, Lea.
  - **devia**, Gld.[1]
  - **profunda**, Say.
  - **Sayii**, Binn.
- **Acanthinula harpa**, Say.
- **Vallonia pulchella**, Mull.
- **Fruticicola hispida**, L.
  - †**rufescens**, Penn.
- **Dorcasia Berlandieriana**, Mor.
  - **griseola**, Pfr.
- **Aglaja fidelis**, Gray.
  - **infumata**, Gld.
  - †**Hillebrandi**, Newc.
- **Arionta arrosa**, Gld.
  - **Townsendiana**, Lea.[2]
- **Arionta tudiculata**, Binn.
  - **Nickliniana**, Lea.
  - **Ayresiana**, Newc.
  - **redimita**, W. G. Binn.
  - †**intercisa**, W. G. Binn.
  - **Kelletti**, Fbs.
  - **Stearnsiana**, Gabb.
  - **exarata**, Pfr.
  - **ramentosa**, Gld.
  - †**Californiensis**, Lea.
  - **Carpenteri**, Newc.
  - †**Mormonum**, Pfr.
  - **sequoicola**, J. G. Cooper.
  - **Diabloensis**, J. G. Cooper.
  - **Traski**, Newc.
  - †**Dupetithouarsi**, Desh.
  - **ruficincta**, Newc.
  - **facta**, Newc.
  - †**Gabbi**, Newc.
- **Glyptostoma Newberryana**, W. G. Binn.
- **Euparypha Tryoni**, Newc.
- **Tachea hortensis**, Müll.
- **Pomatia aspersa**, Müll.

*

- **Cylindrella Poeyana**, Pfr.
  - †**jejuna**, Gld.
- †**Macroceramus Kieneri**, Pfr.
  - **Gossei**, Pfr.
- †**Bulimulus multilineatus**, Say.
  - †**Dormani**, W. G. B.
- †**Bulimulus Marielinus**, Pfr.
  - †**Floridanus**, Pfr.
  - †**patriarcha**, W. G. B.
  - **alternatus**, Say.
  - †**Schiedeanus**, Pfr.
  - **dealbatus**, Say.

ORTHALICINÆ.

- **Liguus fasciatus**, Mull.
- **Orthalicus zebra**, Mull.
- **Orthalicus undatus**, Brug.
- **Punctum minutissimum**, Lea.

SUCCININÆ.

- †**Succinea Haydeni**, W. G. B.
  - †**retusa**, Lea.
  - **Sillimani**, Bld.
  - **ovalis**, Gld. not Say.
  - †**Higginsi**, Bld.
  - †**Haleana**, Lea.
  - †**Mooresiana**, Lea.
  - †**Grosvenori**, Lea.
  - †**Wilsoni**, Lea.
  - †**Concordialis**, Gld.
- †**Succinea luteola**, Gld.
  - **lineata**, W. G. Binn.
  - **avara**, Say.
  - **Stretchiana**, Bld.
  - †**Verilli**, Bld.
  - †**aurea**, Lea
  - †**Groënlandica**, Beck.
  - **obliqua**, Say.
  - **Totteniana**, Lea.
  - **campestris**, Say.

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[1] *H. Mullani* is a variety of this.

[2] *H. ptychoptora*, Brown, is a variety of this.

†Succinea Hawkinsi, Bld.
†rusticana, Gld.
Nuttalliana, Lea.
†Succinea Oregonensis, Lea.
effusa, Shuttl.
†Salleana, Pfr.

VERONICELLIDÆ.

Veronicella Floridana, Binn.
†Veronicella olivacea, Stearns.

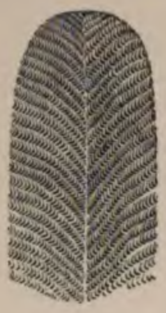
A. *Jaw absent.*

Family OLEACINIDÆ.

Genus **GLANDINA**, Schum.

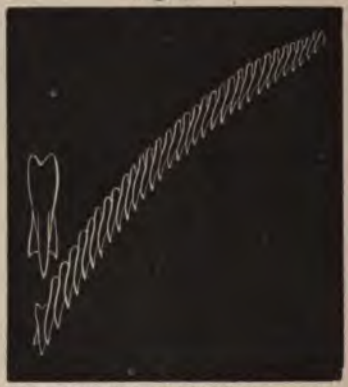
Lingual membrane narrow, with chevron-shaped rows of uniform, aculeate, separated teeth; central tooth with a long, slender, straight base of attachment, with incurved sides, and with inferior lateral slightly expanded angles, and with the upper margin reflected and extended into a long, slender, acutely pointed cusp. There are no lateral teeth, the balance of the membrane being composed of marginal teeth of the pure aculeate form.

Fig. 1.



Lingual membrane of *G. truncata*.

Fig. 2.



Lingual dentition of *Glandina truncata*.

Each row of teeth on either side of the median line curves first backward, with the teeth rapidly increasing in size as they pass outwards, and then forwards as the teeth gradually again become smaller; giving an irregularly crescentic shape to the half row of teeth. This is shown particularly in *Gl. Altersi* and *G. rosea*, less so in *Gl. truncata*. The central tooth was overlooked by Wyman, Leidy, and other of the earlier investigators. It has since been detected in *Gl. truncata*,[1] *rosea*,[2] *algira*,[3] *Sowerbyana*,[4] *plicatula*,[5] *fusiformis*,[6] *Albersi*;[7] in *semitarum*,[8] *Phillipsi*[9] of the subgenus *Varicella;* also *solidula*[10] of subgenus *Oleacina*. This central tooth is rather difficult to study, being on a different plane than the other teeth, and apparently much less developed. Its cusp is generally simple, long, and narrow; but in *G. rosea* it has a decided blunt cutting point, and in *G. semitarum* it has a long, slender, cutting point.

The side teeth are all of the purely aculeate type; the base of attachment is long, narrow, incurved at sides, gradually rounded above, expanded and bluntly truncated below, the general outline being somewhat like that of the sole of a shoe. From this base of attachment springs a large aculeate cusp. These side teeth are like the marginals in *Zonites*, *Limax*, etc.; they may therefore be called marginal teeth, and the lateral teeth, usually present in the *Vitrininæ*, may be said to be entirely wanting.

As stated above, the marginal teeth increase rapidly in size for a short distance from the median line, and then gradually decrease in size, as they pass off laterally, the last tooth being still smaller than the first.

Glandina truncata has 32—1—32 teeth in each row. I have shown in plate I., fig. 1*a*, the central and first three marginals; *b* is the twentieth marginal; *c*, the last tooth. Fig. *a* and *c* show the teeth as seen from below, thus giving a perfect view of the bases of attachment. Fig. *b* is a strictly profile view. The eighth tooth seems to be the largest. The central tooth I find great difficulty in studying. It appears to have a simple, long, slender base of attachment, truncated above and below with slightly expanded lateral angles. The sides are somewhat incurved, giving the tooth the appearance of a simple modification of the base of attachment of the marginals. The figure (2) by Morse, copied above, gives a better illustration of this central tooth than is shown in my plate. I have lately verified it in fine specimens collected by myself in Florida.

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[1] See L. and Frw. Shells, I., fig. 6.

[2] Amer. Journ. Conch., V. 202, fig. 1.

[3] Fischer and Crosse, J. de C. XVI. 234, 1868; Moll. Mex. et Guat., pl. IV. fig. 10.

[4] Same, Moll. Mex. et Guat. 73, pl. IV. figs. 6–9.

[5] Same, p. 73.

[6] Same, p. 73.

[7] L. and Frw. Shells, I., fig. 10, p. 19.

[8] Proc. A. N. S. Phil. 1874, 49.

[9] Same.

[10] Ann. Lyc. N. H. of N. Y., X. 347.

In illustrating the dentition of this genus, I have given fig. 1, copied from Dr. Leidy's figure in Terr. Moll. U. S., to show the general arrangement *en chevron* of the rows of teeth. Fig. 2 by Morse, copied from L. and Frw. Sh. N. A., I., gives one-half of one transverse row of teeth, with the central tooth. Fig. 1 of my plate is intended to show the shape of the individual teeth: *a* gives the central with adjacent marginals; *b*, the twentieth marginal in profile; *c*, the thirty-second and last marginal.

I have not had an opportunity of examining the lingual membrane of *G. bullata*, *Texasiana*, *decussata*, or *Vanuxemensis*.

B. *Jaw present.*

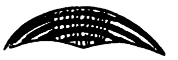
Family HELICIDÆ.

This family may be divided by the character of its jaw in connection with that of its dentition into several subfamilies, *Vitrininæ*, *Helicinæ*, *Orthalicinæ*, *Succininæ*. The characteristic of each will be given below.

a. Jaw in one single piece; marginal teeth aculeate. VITRININÆ.

Genus MACROCYCLIS, Beck.

Fig. 3.



Jaw of *Macrocyclis Vancouverensis.*

Jaw crescentic, ends sharply pointed, anterior surface striated; cutting margin smooth, with a median projection. I have examined the jaw of *M. Vancouverensis* (see fig. 3, copied from L. and Frw. Sh., I.), *concava*, *Duranti*, *Voyana*, and in the West Indian species, *M. Baudoni*,[1] Petit, and *M. euspira*, Pfr.

The general arrangement of the lingual membrane of *Macrocyclis* is the same as I have described above for *Glandina*.

There are 32 rows in one lingual examined of *M. Vancouverensis*. The rows of teeth are arranged *en chevron*. Each row is

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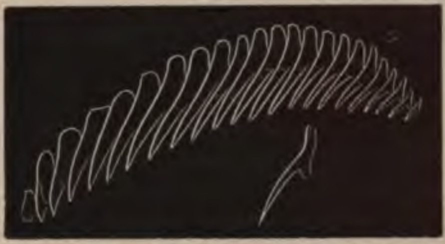
[1] See Am. Journ. Conch. VII. 175; Ann. Nat. Hist. N. Y., X. 305.

Fig. 4.



Lingual dentition of *Macrocyclis Vancouverensis*.

divided by the median line into two irregular crescents, the teeth rapidly increasing and curving in a backward direction, and then gradually decreasing in size and curving forward. In *M. Vancouverensis* the sixth tooth is the largest. One of these subcrescentic rows is shown in fig. 4, copied from L. and Frw. Sh., I., drawn by Morse. This figure, however, must not be used to judge of the shape of the separate teeth, better shown in plate I. The teeth of *Macrocyclis*, as also of *Glandina*, are separated, not crowded, as in the *Helicinæ*. The central tooth is seen with some difficulty by the microscope. I am confident, however, that I have drawn it correctly for the various species. In *M. Vancouverensis* (pl. I., fig. 4), the base of attachment is small, triangular, the apex pointed backward, the angles bluntly rounded, somewhat incurved at base, and bears a delicate, simple, short, slender cutting point, reaching from about its centre to near its base. This cutting point was not figured by Morse (see above fig.), and, indeed, was observed by me only on a few of the central teeth, and then with difficulty. In *M. concava* (pl. I., fig. 3) the central tooth has a larger base of attachment, the apex of the triangle is truncated and incurved, the base is more incurved, the outer lower corners more expanded and pointed, the cutting point more developed, with distinct lateral expansions like very slightly developed subobsolete side cusps. In *M. Voyana* (pl. I., fig. 5), the central tooth has a long, narrow, quadrangular base of attachment, incurved above, below, and at sides, and bears near its base three small, sharp cutting points, the median the largest; there seems to be no distinctly developed cusps bearing these cutting points. In *M. Duranti* the central tooth has a base of attachment somewhat like that of *M. Vancouverensis*, but longer, and with incurving sides; the cutting point is the same. I have not examined the lingual membrane of *M. sportella*, which may be merely a variety of *Vancouverensis*. The other species mentioned above are readily distinguished one from another by the form of their central teeth.

I may here mention that Tryon (Am. Jour. Conch., II. 246) erroneously includes in *Macrocyclis* a true species of *Zonites*, *Z. Elliotti*, characterized by caudal mucous pore, parallel longitudinal furrows above the margin of the foot, and the presence of perfect lateral teeth.

The side teeth of *Macrocyclis* at first sight, especially when seen from below, appear to be of the purely aculeate type, as the marginals in *Zonites* and *Limax*. From this, one is inclined to consider them all as marginals, and to declare that no true lateral teeth exist, thus making *Macrocyclis* to agree with *Glandina* in this particular also. A more careful study shows us that the teeth nearest the median line are modified from the aculeate type, though they do not have the distinct form of the laterals of *Zonites*, with decided cusps and cutting points. They seem rather to represent those teeth of *Zonites* which show the transition from the laterals to the marginals (see pl. II., fig. 2, the second lateral tooth of *Z. lævigatus*). It may be said, therefore, that the lateral teeth are entirely wanting in *Macrocyclis*, the first side teeth being laterals in the transition state, the balance being pure marginals. (See, however, *M. cuspira*, below, which has a lingual membrane of *Glandina*.) The base of attachment of these transition teeth is like those of the marginals, i. e., sole-like, except that the lower lateral expansions are more developed and angular, and in *concava* and *Voyana* the lower edge is excurved rather than incurved. The cusps are long and slender, lengthened into cutting points; the teeth are unsymmetrical by the greater development of the outer subobsolete side cusps, both of these cusps being distinctly indicated by expansion. In *M. Vancouverensis* there is apparently a small sharp side point on the inner side of the cusp. I am not certain of its character, and have not ventured to figure it, excepting on the second tooth in fig. 4*a*. This process is seen on the first six teeth only. The balance of the teeth beyond the transition teeth in all the species are marginals of the pure aculeate type. They vary in sharpness in different parts of the same membrane, as will be seen by comparing my figure 4*b* of *M. Vancouverensis* with the marginals in profile given by Morse (see above fig. 2). In *M. Duranti* the extreme marginals are large in comparison with those of the other species.

In studying my figures, it must be remembered that fig. 3*a*, 5*a*, and 4*c* are drawn as seen from above, to show the form of the cusp. The other figures are drawn from below, to show the base of attachment.

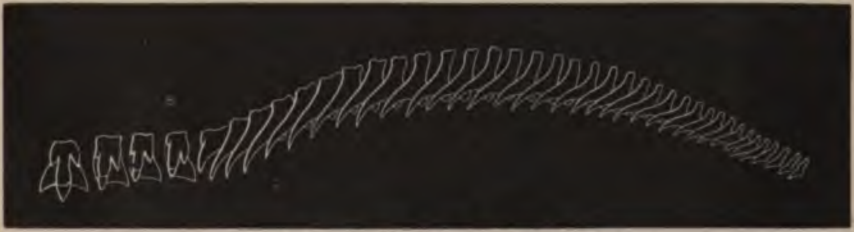
M. Vancouverensis, drawn by Morse, has 22—1—22 teeth, two other membranes examined by me gave 24—1—24, one other 18—1—18. *M. concava* has given 20—1—20, 23—1—23, and 25—1—25. Of *M. Duranti* I have counted but one membrane having 18—1—18. A single membrane of *M. Voyana* had 24—1—24 teeth.

To sum up the characters of the dentition of *Macrocyclis* it may be said to be intermediate between *Glandina* and *Zonites*, differing from the former in the presence of the transition teeth from true laterals to true marginals, differing, however, from the latter by the absence of true lateral teeth.

Genus **ZONITES**, Montf.

In the preceding genus *Glandina* we found only the aculeate form of teeth or pure marginals; in *Macrocyclis* we found in addition to these marginals a few showing a modification of this type, being the transition teeth from marginals into laterals. In the present genus, *Zonites*, we find for the first time the lateral teeth in their full development. Thus we have the three forms of teeth, centrals, laterals, and marginals, all present, and apparently a generic characteristic. It will be noticed, however, that in *lævigatus*[1] (pl. II., fig. 1, 2) there is no perfect lateral, the first tooth showing a decided modification or transition into the marginals. Thus we cannot say that in all species of *Zonites* there are pure lateral teeth. It will be seen below that in some species the number of laterals is reduced to two.

Fig. 5.



General view of dentition of *Zonites indentatus*.

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[1] See also *cellarius*.

I give in fig. 5 a general view of the arrangement of the teeth in *Zonites.*[1] The centrals have a base of attachment longer than wide, subquadrate, with lateral expansions at the corners of the lower margin. The reflected portion varies in size in the various species, from highly developed in *viridulus* (pl. XVII., fig. 6) and others, to slightly developed in *lasmodon* (pl. III., fig. 7) and others; in the latter case resembling the short reflection of *Vitrina.* The reflection always bears a more or less developed central cusp, generally reaching to or beyond the lower margin of the base of attachment, and always bearing a distinct cutting point, which last, like the cusp, is usually slender, and projects over the tooth of the adjoining transverse line. The side cusps of the reflected portion of the tooth are usually subobsolete, but they are distinctly developed in *Z. lasmodon* (pl. III., fig. 7), *suppressus* (pl. XVII., fig. 11), *Gundlachi* (pl. III., fig. 10), *capsella* (fig. 4), *gularis* (fig. 1), *arboreus* (pl. XVII., fig. 4), *cellarius* (pl. II., fig. 3), *lævigatus* (fig. 1, 2), *significans* (pl. XVII., fig. 10), *ferreus* (pl. XVII., fig. 9), *viridulus* (pl. XVII., fig. 6), *nitidus* (pl. XVII., fig. 7), *fulvus* (pl. XVII., fig. 5), *milium* (pl. XVII., fig. 8). On the side cusps are distinctly developed cutting points in all the species I have examined, excepting *lævigatus* and *cellarius*, in which I find no trace of cutting points. These points when present vary in development in the various species, generally disposed to be triangular and somewhat aculeate in form, thus bearing a resemblance to the cusp of the marginal teeth. The greatest development of these cutting points is seen in *Z. capnodes* (pl. II., fig. 6; pl. III., fig. 12). I have given on pl. III., fig. 12, an enlarged view of a central in *Z. capnodes; a b c d* gives the base of attachment, *e* the reflected portion of the tooth, *f f* the subobsolete side cusps, *h* the median cusp, *i* the cutting point of the median cusp, *g g* the cutting points of the side cusps. The general outline of the central tooth is graceful and slender as compared with the other genera, except *Limax* and *Vitrina.*

The lateral teeth in *Zonites* are of the same type as the central but are rendered unsymmetrical (as usual in the land shells) by, the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp and cutting point. It is only in *Z. Gundlachi* (pl. III., fig. 10) that I have observed the inner side cutting point, and in this species, even, the lateral teeth are still sufficiently unsymmetrical to be readily distinguished from the centrals; in *Z. Binneyanus* there is also a kind of inner cutting point. As mentioned above, the number of these lateral teeth varies in the respective species, and is so nearly constant as to be, I believe, a good specific character. I find, however, some difficulty in deciding in all cases where the true laterals end and the transition teeth commence, so gradual is the change in some species. Of two linguals of *Z. intertextus* examined, I found one to have 12, the other 14, perfect laterals. The number of lateral teeth in the different species is given below.

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[1] The characters of the separate teeth of this species are better shown in pl. XVII., fig. 3.

The teeth forming the gradual change from laterals to marginals are best illustrated in the case of *Z. lævigatus* (pl. II., fig. 2), the first four side teeth being transition teeth. As already stated above, this species wants entirely the perfect laterals. In *Z. cellarius* (pl. II., fig. 3) the two transition teeth have an inner lateral spur near the top of the cusp. The only lateral of this species has also peculiarities in its form easily seen in the figure, but difficult of description.

The marginal teeth of *Zonites* are quite like those of *Glandina* and *Macrocyclis* (see above). The curve of the transverse rows, the rapid increase and gradual decrease in size as they pass off laterally, is shown in pl. II., fig. 1, 3, and in the several wood-cuts I have given. The number of marginal teeth in each species examined is given below; it must be borne in mind, however, that the number is not constant in any given species, though the range of variation in number seems limited in the respective species. Thus, though I have found a slight difference in the count of teeth of *Z. inornatus*, I have every reason to believe I shall never find it to have as many teeth as in *Z. fuliginosus*. It appears, therefore, that the count of teeth has a decided specific value, at least in most cases.

The rapid increase and subsequent gradual decrease in size of the teeth as they pass off laterally, though it appears usually a generic character, is somewhat modified in some species. Thus in one lingual membrane of *Z. intertextus* examined I find a much more gradual and regular decrease from the first to the last marginal tooth.

The marginal teeth in *Zonites*, and, indeed, all the *Vitrininæ*, are more separated than in *Helix*, and the separate rows are more widely removed the one from the other, especially near the outer margin of the membrane.

Though the simple aculeate form of marginals seems a generic character in *Zonites*, we find the marginals bifid in *Z. fulvus* (pl. XVII., fig. 5), and bifid or even trifid in *Z. Gundlachi* (pl. III., fig. 10), also for the first four marginals in *milium*. This character reminds us of *Vitrina* (see below); *Vitrinoconus* (Semper, Phil. Archip., 91); *Vitrinoidea* (Ibid., p. 85); *Vitrinopsis* (Ibid., p. 86), and the numerous genera of disintegrated *Nanina;* also some species of *Limax*. The first marginals of *Z. exiguus* have a side spur.

Taking the general characters of dentition into consideration *Zonites* is nearest allied to *Limax* among our genera, but in the latter the marginals are generally more slender or spine-like, and have a less sole-like base of attachment.

The approximate count of teeth in the various species now follows:—

Zonites capnodes (pl. III., fig. 12; pl. II., fig. 6) has 66—1—66 teeth, with 9 perfect laterals on each side the median row. Another specimen gave 46—1—46 teeth, with 70 rows of teeth in all.

Z. fuliginosus (pl. II., fig. 7) gave 87 rows of 64—1—64 teeth. Another specimen 57—1—57. Both linguals have 4 perfect laterals. Fig. 6 gives the eighth marginal from the outer edge.

Z. friabilis (pl. II., fig. 4) has 57—1—57 teeth with 6 laterals. Fig. *b* gives the extreme marginals of two adjacent rows.

Z. caducus[1] is known only by the description and figure of Fischer and Crosse (Moll. Mex. et Guat. 149, pl. VIII., fig. 13–16). There are 75—1—75 teeth with 5 laterals.

Zonites lævigatus (pl. II., fig. 1, 2) is peculiar in having no cutting points to the side cusps of the central teeth, and no perfect lateral teeth. I found in one specimen 28 rows of 19—1—19 teeth. Another specimen had 17—1—17 teeth. One-half of one transverse row with the central tooth is figured on pl. II., fig. 1. A more enlarged view of a portion is given in fig. 2.

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[1] I will here mention that Semper, Archip., Phil. 78, pl. III., fig. 27; pl. V., fig. 21, figures the genitalia, jaw, and dentition of a *Zonites* from Tennessee, which he refers to *Z. lucubratus*, Say. I do not know what species he had before him. *Z. lucubratus* is not found in Tennessee. See Ann. N. Y. Lyc. N. H., pl. XI., fig. 24.

Z. demissus (pl. III., fig. 6, *b* is the 15th tooth) has 45—1—45 teeth, with 15 laterals. My specimen was one of the large East Tennessee form, called *Z. acerrus* by Dr. Lewis. The typical form from near Mobile has, however, a perfectly similar dentition.

Z. ligerus (pl. III., fig. 11, *b* is the 18th tooth ; *c*, a profile of one nearer the central line). Teeth 38—1—38 with 14 laterals.

Z. intertextus (pl. III., fig. 8, *b* is from near the outer margin). I find difficulty in counting the teeth on one specimen examined by me, but I believe there are 61—1—61. There are 12 perfect laterals. Another specimen has 55—1—55 with 12 laterals.

Z. subplanus, not examined.

Z. inornatus (pl. II., fig. 5, fig. *b* is the 21st tooth). One specimen had 37 rows of 23—1—23 teeth. Another had 26—1—26. Both had only two perfect laterals.

Z. sculptilis (pl. III., fig. 2, *b* are extreme marginals) 40—1—40 teeth with 4 perfect laterals.

Z. Elliotti (pl. III., fig. 5, *b* an extreme marginal) 32—1—32 teeth with 6 perfect laterals.

Z. cerinoideus, not examined.

Z. cellarius (pl. II., fig. 2, one-half of one transverse line with the median tooth) 14—1—14 teeth. There can hardly be said to be one perfect lateral. For the other abnormal characters of this lingual membrane see p. 163. The figures of dentition of the foreign form (by Lehmann, Lindström, etc.) agree with mine.

Z. Whitneyi, not examined.

Z. nitidus. See Lehmann, Lebenden Schnecken, etc. p. 72, pl. X., fig. 23, for description and figure of the European form. In a specimen from Baldwin County, Alabama, furnished by Dr. E. R. Showalter, I find 25—1—25 teeth with 5 laterals—(pl. XVII., fig. 7, *b* is an extreme marginal.) Lehmann gives 28—1—28.

The specimen examined had the dart-sac and dart described in the European form.

Z. arboreus. Morse gives 82 rows of 21—1—21 teeth each. My specimen (pl. XVII., fig. 4, *b* is an extreme marginal) has about 16—1—16 with 5 perfect laterals. There are distinct side cusps as well as cutting points to the central and lateral teeth.

Z. viridulus (pl. XVII., fig. 6). Morse gives 54 rows of 27—1—27 teeth each. I have figured the central and first lateral, with one extreme marginal tooth, drawn from a specimen furnished me by Mr. Allen of Orono, Maine. I find three lateral teeth.

Morse gives a similar figure. The European *Z. viridulus* as figured by Lehmann (*Z. purus*) has a similar dentition; he gives 23—1—23 teeth, with 3 laterals.

There are decided side cups as well as cutting points to central and lateral teeth.

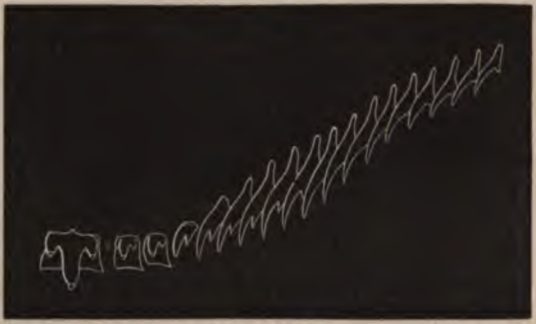
Z. indentatus (pl. XVII., fig. 3). The lingual examined has 38—1—38 teeth, with 3 perfect laterals. Morse counted 53 rows of 39—1—39 teeth, also three perfect laterals.

Z. limatulus (pl. III., fig. 3), has 23—1—23 with 5 laterals.

Z. minusculus (pl. XXI., fig. 9). Morse's figure shows four perfect laterals. He counted 52 rows of 12—1—12 teeth. It will be noticed that his figure does not show the cutting points of the side cups of the central and lateral teeth, which I have found in specimens lately examined from Florida. I found a similar number of teeth.

Z. milium is described by Morse (fig. 6), as having 68 rows, of 17—1—17 teeth, with only 2 perfect laterals. The next six teeth are shown to be bifid, not only the one or two transition teeth, but the decided marginals. I have also drawn the membrane of this species (pl. XVII., fig. 8). I found 18—1—18 teeth, with 3 laterals.

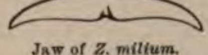
Fig. 6.



Z. milium.

The peculiarity of the lingual of this species is the great development of the central tooth. The jaw also is peculiar in having vertical channels worn upon its anterior surface, extending down to the cutting margin (see fig. 7, copied from Morse). These chan-

Fig. 7.



Jaw of *Z. milium.* [Morse.]

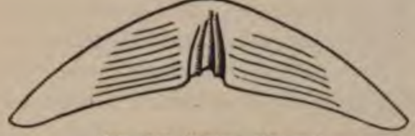
nels are probably worn by the greatly developed central tooth of the lingual membrane. I do not agree with Morse in considering the great development of the central tooth, and the channels on the jaw as generic characters.

Z. Binneyanus is described by Morse with 60 rows of 23—1—23 teeth, with two perfect laterals which have a form of inner side cutting point.

On pl. XVII., fig. 13, I give a figure of the teeth on a membrane examined by me, kindly furnished by Mr. Anson Allen, of Orono, Maine. I find 19—1—19 teeth, with 3 laterals. I doubt there being any inner cutting points to the lateral teeth.

Z. ferreus (pl. XVII., fig. 9), is described by Morse with 39 rows of 20—1—20 teeth. I found 20—1—20 teeth also, with 2 laterals. The central tooth is greatly developed, and the jaw (fig. 8) has vertical median channels, or groves, as in Z. milium (see above, fig. 7).

Fig. 8.

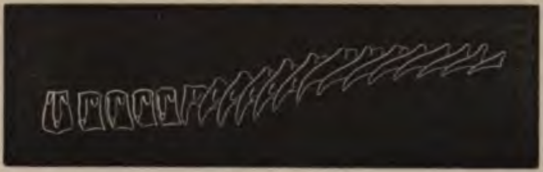


Jaw of *Z. ferreus.* [Morse.]

Z. conspectus, not examined.

Z. exiguus. I give here a copy of Morse's figure, having 69 rows of 16—1—16 teeth, with 4 perfect laterals. The transition teeth and several of the adjoining marginals are described by Morse with a small side spur to their cusps, apparently of the same type as I have figured for *Macrocyclis Vancouverensis* (pl. I., fig. 4). On pl. XVII., p. 14, I give a drawing of a specimen examined by me. I found 16—1—16 teeth with 5 laterals.

Fig. 9.



Z. exiguus.

Z. chersinellus, not examined.

Z. capsella (pl. III., fig. 4), 25—1—25 teeth, with 3 perfect laterals, and one transition tooth.

Z. fulvus. Morse gives 80 rows of 18—1—18 teeth, with 7 laterals. The specimen examined by me (from Orono, Maine) has 30—1—30 teeth with 8 perfect laterals. The difference in the marginals is unusual for two individuals of the same species.

The peculiarity of the lingual is the bifurcation of all the marginal teeth. On pl. XVII., fig. 5, I have drawn one central with its adjacent lateral, and one marginal extracted from a Maine specimen.

By the bifurcation of the marginals this species is allied to *Z. Gundlachi*, which, however, has even some of its marginals tricuspid, and tricuspid laterals.

The American form here under consideration was described by Mr. Say under the name *chersina*. Judging from its shell alone, it seems identical with the European *L. fulvus*. It has thus been considered one of the circumpolar species common to the three continents. My confidence of this identity is now shaken by a study of the description and figure by Lehmann (Lebenden Schnecken, etc., p. 79, pl. X., fig. 24), of the dentition of the European *Z. fulvus*. He gives 86-100 rows of 25—1—25 teeth, the first two laterals he makes tricuspid, while they are only bicuspid in our form. The marginals appear to be bifid. The question of identity must therefore be considered as still open.

Z. Fabricii, not examined.

Z. Gundlachi (pl. III., fig. 10, *b*, shows two marginals from two adjoining transverse rows), 23—1—23 teeth, with 4 perfect laterals. This lingual is peculiar in having its marginals bluntly bifid, as in *Nanina* and *Vitrina*. Some of the marginals are even trifid. The laterals are also tricuspid.

Z. Stearnsi, not examined.

Z. gularis (pl. III., fig. 1), has 30—1—30 teeth, with 10 perfect laterals.

Z. suppressus (pl. XVI., fig. 2, *b* are marginals from near the edge of the membrane). Teeth 30—1—30, with 8 perfect laterals.

Z. lasmodon (pl. III., fig. 7, *b* the smaller figure shows the 38th tooth). Teeth 41—1—41, with 9 perfect laterals.

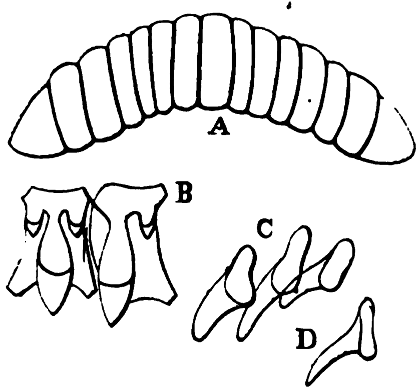
Z. significans (pl. XVII., fig. 10). 16—1—16, with 2 perfect laterals.

Z. internus (pl. III., fig. 9, *b* shows the 17th and 18th teeth, *c* the last tooth). Teeth 28—1—28, with 4 laterals.

Z. multidentatus (pl. XVII., fig. 1). The lingual examined had 14—1—14 teeth, with 2 perfect laterals. Morse gives 68 rows with 15—1—15 teeth, also 2 perfect laterals.

After my paper was prepared I have had an opportunity of examining the jaw and tongue of *Z. Lansingi*. It will be seen below that its ribbed jaw and aculeate marginal teeth do not sustain my assertion (p. 146) that for the larger divisions these organs may be relied on as systematic characters. The result of my examination of this species was as unexpected as it is puzzling.

Fig. 10.



Jaw (fig. 10, A) low, wide, slightly arcuate; ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with 14 broad, unequal, crowded, flat ribs, slightly denticulating either margin.

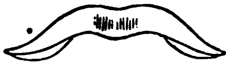
The first impression given by the jaw is that it bears narrow, separated ribs, as in *Bulimulus*, *Cylindrella*, etc. A more careful study of it, however, shows the ribs to be very broad, crowded, flat, with narrow interstices between them.

Lingual membrane with 17—1—17 teeth: 6 laterals. Centrals (fig. 10, B) with the base of attachment longer than wide, the lower lateral angles expanded; upper margin broadly reflected; reflection very short, tricuspid; side cusps decidedly developed, short, bearing distinct cutting points; median cusp long, slender, bulging at sides, reaching nearly to the lower edge of the base of attachment, beyond which projects slightly the distinct, long cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and inner side cusp and cutting point. Marginals (C) aculeate, their bases of attachment less sole-like than in *Zonites*, but more circular in outline.

Fig. 10, C, shows these bases of attachment. Fig. 10, D, gives one marginal tooth in profile.

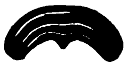
This is the first known instance of a species with ribs on its jaw having aculeate marginal teeth, or of a species furnished with a *Zonites*-like shell having decided ribs upon the jaw. It will be difficult to find a place for the species under any description of genus or subfamily. The shell is that of *Zonites*, but that genus has a ribless jaw with median projection.

Fig. 11.



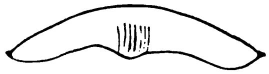
Jaw of *Z. arboreus*. [Morse.]

Fig. 12.



Jaw of *Z. fuliginosus*.

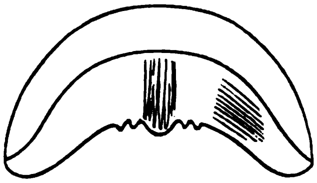
Fig. 13.



Jaw of *Z. indentatus*. [Morse.]

The jaw of *Zonites* is arcuate, ends acuminated, often recurved; anterior surface without ribs; cutting margin with a beak-like projection.

Fig. 14.

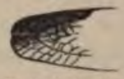


Jaw of *Z. Binneyanus*. [Morse.]

I have examined the jaws of almost all the species enumerated above. There is considerable variation in their form, but the general characters are constant. Sometimes there is a vertical median carina, as in *Z. minusculus*. Some species have vertical striæ, especially on the middle of the jaw (see fig. 14). Some have strong transverse lines of reinforcement (see fig. 12). In several species, such as *Z. viridulus* and *Z. Binneyanus* (fig. 14), Morse has detected projecting points on the cutting edge of the side of the median beak. But I did not find them in a specimen of the last species examined by me; it is very high. That of *Z. exiguus* is very low. The median vertical grooves in some species have been mentioned above (fig. 7 and 8).

Formerly I separated the above species into two genera, *Zonites* and *Hyalina*, respectively characterized by the presence or absence of a distinct locomotive disk to the foot, and well-marked furrows running above, and parallel to, the edge of the foot, meeting above the extremity of the tail over a distinct caudal mucous pore (fig. 15). I now place them all in *Zonites*, as all I have examined are so characterized, and I believe all will prove to be so. (See Ann. N. Y. Lyc. N. H., X. 164.)[1]

Fig. 15.



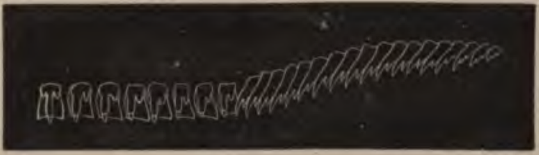
Tail of *Zonites suppressus*, enlarged.

The external orifice of the generative organs in the species I have examined is quite under the mantle, not on the right side of the head, as inadvertently stated on p. 29 of L. and Frw. Shells, I.

Genus **VITRINA**, Drap.

To the description of the animal on p. 29 of L. and Frw. Sh. N. A., I., must be added the fact of there being a distinct locomotive disk to the foot.

Fig. 16.



Lingual dentition of *V. limpida*. [Morse.]

The jaw is highly arched, ends acuminated, blunt; anterior surface smooth; cutting margin with a prominent beak-like median projection. I have figured the jaw of *V. limpida* on pl. XVI., fig. 3. I have found it to be the same in *V. exilis* and *Pfeifferi*. I have not examined either jaw or lingual membrane in *V. Angelicæ*. Fig. 16 gives a general idea of the lingual membrane. The centrals have a quadrangular base of attachment, longer than broad.

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[1] I have also observed the caudal pore in *limatulus*. *Z. arboreus* has the longitudinal furrows, but on account of the transparent tissue of the foot I find it difficult to distinguish any caudal pore.

In *Z. ligerus* there are well-marked lines running obliquely towards the centre of the base of the foot, where is an extremely narrow line, representing, no doubt, the locomotive disk. The other characters of *Zonites* are present in the species.

The reflection is short, with three distinct cusps, the median long and slender, bulging at the sides, the outer ones very short; all the cusps bear cutting points in proportion to their length. The lateral teeth are arranged in straight transverse rows. They are like the centrals, but unsymmetrical by the partial suppression of the inner side cusp and inner lower lateral expansion of the base of attachment, and the complete suppression of the cutting point to the inner side cusp. The marginals have a sole-shaped base of attachment, and truly aculeate cutting points, which, however, are bluntly bifid at their points. The marginals are in oblique, curving rows, gradually decreasing in size of the teeth as they pass off laterally. They do not first increase and then decrease, as in *Zonites* and *Glandina*, or not, at all events, to the same degree. In *V. limpida*, as stated below, the seventh marginal appears, however, to be the largest.

In *V. limpida* I have counted 30—1—30 teeth, with 9 perfect laterals. The seventh marginal is the largest. Another gave 39—1—39, with 10 perfect laterals. The membrane figured by Morse had 25—1—25 teeth, with 9 laterals. I have figured of this species on pl. IV. one central and its adjacent lateral in fig. 8 *a*, and the twenty-third tooth, which is one of the marginals, in fig. 8 *b*.

Vitrina exilis has about 37—1—37 teeth, with 7 perfect laterals. I have given on pl. IV., fig. 7 *a*, one central and lateral; *b*, a group of marginals; *c*, an extreme marginal.

Vitrina Pfeifferi has over 50—1—50, with 10 perfect laterals. I figure a group of centrals and laterals, pl. IV., fig. 6 *a*, and one extreme marginal in *b*.

Genus **LIMAX**, Lin.

The character of the mantle and the peculiarities of the lingual dentition have suggested various subdivisions of this genus into sections, sub-genera, and even genera. I propose, however, to consider the genus in its widest sense, as generally adopted. It will be seen that even in the few species existing in North America, there is considerable variation in the lingual dentition, especially in the bifurcation or non-bifurcation of the marginal teeth, the development of the side cusps to the central and lateral teeth, and the presence or absence of distinct cutting points to these cusps. I shall, however, simply describe the dentition of our species, leaving the question of subgeneric division to the future, and to abler hands.

As some confusion exists in regard to the specimens furnishing the descriptions and figures published in this country, I have taken pains to be sure of the specific identity of each specimen now before me.

The *L. maximus* was collected in Newport, R. I., by my friend, Mr. Sam. Powel It is the same individual figured on p. 408 of my edition of Gould's Invertebrata of Massachusetts. The external markings of the animal are conclusive proofs of its identity with the European species. I have, however, made it still more certain by examining the genitalia, which I find agree with those of *L. maximus*, figured by Lehmann (Lebenden Schnecken, etc.). I find the dentition agrees also with the figures given by Heynemann (Malak. Blatt. X.), Lehmann (l. c.), and Goldfuss (Verhl. Naturh. Vereins der Preuss. Rheinl., etc.).

The *L. flavus* was collected in a cellar in Burlington, N. J. It not only agrees with the figure in the "Terrestrial Mollusks" as far as its outward markings are concerned, but I find also its genitalia to agree with Dr. Leidy's figure in the same work, and also with the figure given by Moquin-Tandon (Moll. Fr.). Its dentition agrees with the figures of Heynemann and Semper (Arch. Phil.).

The *L. agrestis* was collected in a garden in Burlington, N. J. This species I have also found to agree with the figures of the external animal and genitalia given in the "Terrestrial Mollusks," as well as with Moquin-Tandon's (Moll. Terr. et Fluv. de la France) figure of the genitalia, and Heynemann's and Lehmann's figure of the dentition; also with the figure of the genitalia given by Schmidt and Lehmann.

The *Limax campestris* examined was collected in the country near Burlington, N. J., by my friend, A. Ten Eyck Lansing. It agrees with the description and figures in the "Terrestrial Mollusks," not only as to its external characters, but in its genitalia. I will here mention that its dentition does not agree with that of *L. Weinlandi*, Heynemann (l. c. p. 212), supposed by that author to be the same species.

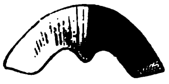
The *Limax Hewstoni* examined is a typical specimen, given by Dr. J. G. Cooper to the State Collection of California. It was labelled by him. There can be no doubt, therefore, of its identity.

The *Limax Ingersolli* was received since this paper was commenced. It has not yet been described.

Being thus confident of the identity of the species before me, I will proceed to describe their jaws and dentition in detail.

I have examined the jaw of all the species, finding it to agree with the well-known character of the jaw in the genus. It is arcuate with slightly attenuated, but blunt ends; anterior surface smooth, cutting margin with a decided beak-like median projection. There is often a central vertical carina to the jaw. The ends are often more pointed than in the jaw figured.

Fig. 17.



Jaw of *Limax*.

Limax maximus, Linn. (pl. IV., fig. 4) has about 76—1—76 teeth. The centrals have a large, subquadrate base of attachment. The reflection is large, subquadrate, and bears a single stout median cusp, which has a short cutting point, often longer than in the teeth figured; the side cusps are subobsolete, and bear no cutting points. The lateral teeth, about 18 in number, are like the centrals, but unsymmetrical. The marginal teeth are aculeate. Only a few are simple, as in fig. *b*, the balance are bifid, as in fig. *c*. The bifurcation of the marginals commences much nearer the median line than in the specimens examined by Lehmann and Heynemann. There are, indeed, but twelve marginals without the bifurcation on one membrane examined.

Limax flavus,[1] Linn. (pl. IV., fig. 1). The specimen examined has about 60—1—60 teeth, with 16 laterals. The centrals and laterals are of the same type as in *L. maximus*, the outer marginals are also bifid. Pl. IV., fig. 1, represents the dentition of the species. On other portions of the same membrane the cutting points are longer and sharper. Fig. *c* represents an extreme marginal. Both of the figures of this species, published by me,[2] were drawn from lingual membranes of another species.

Limax agrestis,[3] Linn. (pl. IV., fig. 3, *a*. *b*. *c*.) has about 50—1—

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[1] L. and Frw. Sh. N. A., I. p. 63, fig. 105, is no doubt *L. agrestis*. Fig. 6, p. 285, of Ann. Lyc. N. H., N. Y., vol. IX., would more correctly represent the dentition of this species, if the extreme marginals were bifid.

[2] The description and figure given by Morse (Journ. Portland Soc. N. H. 1864, 7, fig. 1) of the jaw of this species could not have been drawn from any *Limax*, as it is said to be ribbed. The figure of the lingual membrane, also (pl. III., fig. 2), does not give the impression of aculeate marginals.

[3] The figure given of the marginals of *L. agrestis*, by Lindström (Gotlands

50 teeth, with 18 perfect laterals. The centrals have a much more graceful outline to the reflection than in the two last-named species. The median cusp is longer and more slender, with a more slender cutting point; the subobsolete side cusps are more marked, and bear well developed, triangular, slightly curved cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner lateral lower expansion of the base of attachment. There is, however, an inner cutting point lying against the inner side of the cusp, rather than in a position corresponding to the outer cutting point; it is very difficult of detection, being on a different plane from the outer cutting point, and readily confounded with the inner lower angle of the base of attachment. It is figured by Lehmann and Heynemann. The marginals are long and slender, without bifurcation even on those on the extreme edge of the membrane. Fig. 105 of p. 63 of L. and Frw. Shells N. A. I., probably was drawn from a specimen of this species, certainly not from one of *flavus*.

Goldfuss (l. c. pl. V., fig. 4) omits the cutting points from his figure.

Limax Hewstoni, J. G. Cooper (pl. IV., fig. 2). The centrals and laterals are of the same type as in the last species, with this important difference, that there is a well-developed cutting point of the usual form (not the peculiar form as in *L. agrestis*) to the inner subobsolete cusp of the laterals, and the inner lower lateral expansion of the base of attachment of the laterals is not suppressed as usual to make the laterals unsymmetrical. From this it follows that the central teeth are with difficulty distinguished from the laterals, until the outer ones are reached, when the inner cutting point and inner lower lateral expansion of the base of attachment are suppressed as in the other species of *Limax*. The marginal teeth are not bifid. Teeth 30—1—30, with 14 perfect laterals. Fig. *b* represents the very last marginals. As in the membranes of almost all species of land shells, there is considerable difference in the marginals on different portions of the same membrane. Those figured are the least slender.

This species, by the presence of the inner cutting point of the laterals and non-bifurcation of the marginals, resembles *Limax* (*Amalia*) *gagates*, as figured by Semper (Phil. Archip., pl. XI.), and

nutida Mollusker, pl. I., fig. 3), disagrees with my observation by the bifurcation of the marginals.

Amalia marginata, as figured by Heynemann (l. c. pl. III., fig. 7). Goldfuss also (l. c. 1856, pl. IV., fig. 3) figures the dentition of *L. marginatus* as the same.

Limax campestris, Binney (pl. IV., fig. 5, *a. b. c.*). One specimen has 40—1—40 teeth, 18 perfect laterals. Another gives 36—1—36, with 11 perfect laterals. The centrals and laterals are of the same type as described above in *L. agrestis*, excepting that there is no peculiar inner side cutting point to the first laterals. About half of the marginals are bifid. I find great difficulty, however, in detecting any bifurcation on the extreme marginals.

As stated above, Heynemann's figure of the dentition of *L. Weinlandi* could not have been drawn from this species. I have no information in regard to *L. Weinlandi* other than what I find in Malak. Blatt. X. 212, pl. III., fig. 1. Judging from the dentition alone I should hardly consider it distinct from *agrestis*.

L. campestris differs greatly in its genitalia from *L. agrestis*, to which it has been compared.

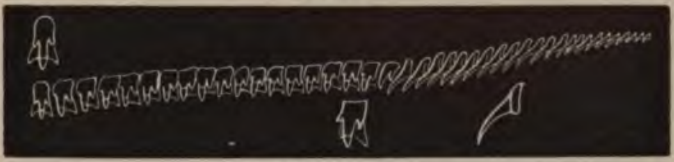
This completes the list of North American *Limaces* now known. I will add that *maximus* and *flavus* are put by Heynemann in the s. g. *Heynemannia; agrestis* in s. g. *Agriolimax; campestris* would be placed by him in s. g. *Malacolimax;* while *Hewstoni* would be placed by him in the genus *Amalia.*

Since the above was written I have received specimens collected in the mountains of Colorado by Mr. Ernest Ingersoll, of a species for which I propose the name *L. Ingersolli.* A full description will be published later. I will here simply state that there are 50—1—50 teeth, with 16 perfect laterals. All the marginals have a blunt spur to the cutting point, so that they may be said to be bluntly bifid.

The dentition of *Limax* is nearly allied to that of *Zonites.* The lateral teeth are arranged in straight transverse rows, the marginals in oblique rows, as aculeate marginal teeth always are. This tendency to obliquity in the rows of aculeate teeth we have seen most plainly shown in *Glandina.* To show the general arrangement of the teeth in straight and oblique rows I repeat the figure by Morse in L. and Frw. Sh. N. A. I., which was probably drawn from *L. agrestis.* It must be borne in mind that this figure is not intended to show the characters of the separate teeth, for which I refer to my plate.

The genus *Limax* differs from *Zonites* in its dentition by having more slender, spine-like marginals, instead of the short, strictly aculeate form. The base of attachment of the marginals in *Limax* is also different, being less sole-like, and more irregularly circular on the extreme marginals. Another difference is that the marginal teeth do not increase in size so rapidly, and then decrease gradually as they pass off laterally, thus giving an irregularly crescentic form to each half of every transverse row. In *L. maximus* the marginal teeth decrease gradually in size from the first to the last. It is the same with *agrestis*, and I believe the character to be generic.

Fig. 18.



Lingual dentition of *Limax*.

b. Jaw in one single piece, marginal teeth quadrate.—HELICINÆ.

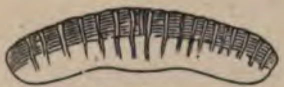
In grouping the genera of *Helicinæ*, I have placed (1) those whose jaw has no distinct ribs upon its anterior surface; (2) those whose jaw has decided stout vertical anterior ribs; (3) those whose jaw has delicate, distant ribs generally running obliquely towards the median line of the jaw.

(1) Jaw without decided ribs on its anterior surface.

Genus **PATULA**, Held.

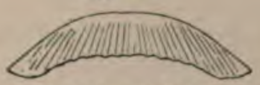
In none of the American species of this genus have I found a jaw with distinct well-formed ribs as in *Helix*. In several species, however, such as *strigosa* and *Cooperi*, there are distinct traces of

Fig. 19.



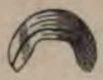
Jaw of *Patula asteriscus*. [Morse.]

Fig. 20.



Jaw of *Patula striatella*. [Morse.]

Fig. 21.

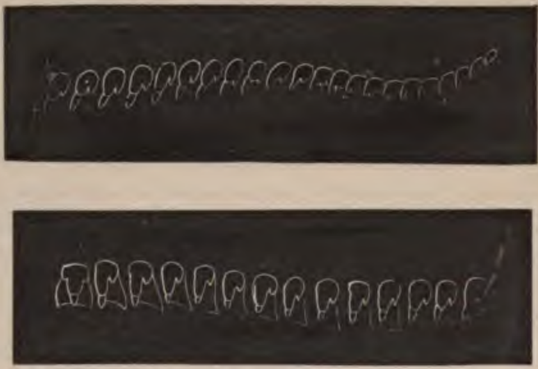


Jaw of *P. alternata*.

subobsolete ribs near the cutting margin. In *asteriscus* there are coarse wrinkles, resembling subobsolete ribs. In *perspectiva*, *striatella*, and *Idahoensis* there are such wrinkles, and also coarse vertical striæ. I have not found the striæ as oblique as shown in fig. 20. In *solitara*, *alternata*, and *Hemphilli* there are no traces of either ribs, wrinkles or striæ. In all these species there is a tendency to a median projection to the cutting edge. This is greatly developed in *solitaria*, *alternata*, and especially in *Hemphilli*. The last two species have also a much more arcuate jaw than the others. I have not seen the jaw of *Haydeni*, *Cumberlandiana*,[1] *tenuistriata*, *Horni*, *pauper*, *incrustata*, or *vortex*.

Patula is described by von Martens as having a ribbed jaw, which does not agree with my observations on the jaw of our North American species. As there appears considerable confusion in regard to the limits of the genus, I think it best to make no reference here to any species foreign to America.

Fig. 22.



Lingual dentition of *P. alternata*. [Morse.]

Fig. 22 shows the general arrangement of the teeth on the membrane. The characters of the individual teeth are better shown on my plate VII.

There is considerable difference in the lingual dentition of the species I have grouped in this genus as to the development of the side cusps to the central and lateral teeth, and the presence of distinct cutting points upon these cusps. Such cusps and points are present in *solitaria* (pl. VII., fig. 9), *alternata* (fig. 5), *perspectiva* (fig. 3), *striatella* (fig. 10), *Hemphilli* (fig. 6), *Idahoensis* (fig. 4), *asteriscus* (pl. XVIII., fig. 9).

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[1] I have lately received a specimen from University Place, Tenn., from Dr. Elliott. The jaw has very coarse perpendicular striæ.

I do not detect these cusps in *P. strigosa* (pl. VII., fig. 1), *Cooperi* (fig. 2), probably the same species, or *Cumberlandiana*, excepting on the outer laterals (see pl. VII., fig. 1 *d*).

The central and lateral teeth of all the species examined by me are, in other respects, as usual in the *Helicinæ*. It will be noticed that the base of attachment is subquadrate, the reflected portion large (except in *asteriscus*), the cusps short, the cutting points short.

All the outlines of the teeth are less graceful than in *Zonites*. The lateral teeth are made unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the less development, if not suppression, of the inner cusp, which loses the cutting point also. The marginal teeth are quite different from those of *Zonites*, *Limax*, *Vitrina*, *Macrocyclis*, and *Glandina* in not being aculeate. They are more crowded than in those genera. They have a quadrate base of attachment, not sole-like, shortened on its inner lower side, but produced at its outer lower margin. The reflected portion is as wide as the base of attachment, is more produced than in the central and lateral teeth, retains its width throughout, and bears two oblique, blunt cutting points, the inner one always much the larger and longer, and the outer one of which, in most of the species, has a tendency to bifurcation. There is considerable variation in these cutting points even in the same lingual membrane, but as a general thing it may be said that the marginal teeth are but a modification of the form of the laterals. They decrease in size greatly at the outer edge of the lingual membrane.

It must be borne in mind that the cutting points vary in development on different portions of any one lingual membrane. I have in each case chosen for drawing such individual teeth as appear best to illustrate the general character of the dentition.

In *P. strigosa* (pl. VII., fig. 1) there are 50—1—50 teeth, with 15 perfect laterals, *c* is an extreme marginal. I give in fig. *e* a central tooth drawn from the membrane of an embryonic young found in the oviduct.

P. solitaria (pl. VII., fig. 9) has 25—1—25 teeth, with 14 perfect laterals. The transition to marginals is very gradual.

P. Cooperi (pl. VII., fig. 2), 29—1—29, with 11 perfect laterals.

P. Hemphilli (pl. VII., fig. 6) has 20—1—20 teeth, with 7 perfect laterals.

P. Idahoensis (pl. VII., fig. 4) has 33—1—33 teeth, with 14 perfect laterals. The transition from the laterals to the marginals, however, is very gradual.

P. Haydeni not examined.

P. alternata (pl. VII., fig. 5). One membrane has 121 rows of 34—1—34 teeth, ten of which are perfect laterals. The variety *mordax*, pl. VII., fig. 7, agrees with it in dentition, except the number of teeth. I counted 20—1—20, with 5 perfect laterals.

P. Cumberlandiana (pl. VII., fig. 8) has 24—1—24 teeth, with about 13 perfect laterals. There is an appearance of a side cutting point to the third tooth, a decided one beyond the sixth.

P. tenuistriata, not examined.

P. perspectiva (pl. VII., fig. 3), 15—1—15 teeth, 7 perfect laterals.

P. striatella (pl. VII., fig. 10), 20—1—20 teeth, with 8 perfect laterals. Morse gives 16—1—16.

P. vortex (pl. XX., fig. 4), 18—1—18, with 8 laterals. A marginal tooth is shown in *b*.

P. Ingersolli, Bland. The species should, perhaps, be placed in *Microphysa*. Jaw of same type as in *H. Lansingi* (above), with 22 ribs. Teeth 16—1—16, with a gradual change from laterals to marginals. The latter are low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt. The side cusps and cutting points of centrals and laterals are well developed.

P. pauper, *Horni*, *incrustata*, not examined.

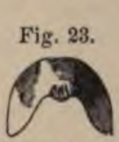
P. asteriscus (pl. XVIII., fig. 9). Morse gives 77 rows of 13—1—13 teeth; 6 perfect laterals. I counted 11—1—11, with 5 perfect laterals. The reflected portion of the central teeth is quite small. The marginal teeth are like those of *Pupa*.

It will be seen that *Patula* differs from all the preceding genera by the presence of quadrate, not aculeate, marginal teeth, a character shared by all the succeeding genera. There does not appear any very essential character in the dentition by which to distinguish it from many of American sub-genera of *Helix*, as will be seen below. It will be noticed that one species, *asteriscus*, has marginal teeth like those of *Pupa* and *Vertigo*.

Genus **HEMITROCHUS**, Sw.

In Ann. Lyc. N. H. of N. Y., X., 341, I have, in connection with my friend Mr. Bland, shown the necessity of using this name in preference to *Polymita*.

Fig. 23.



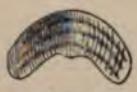
Jaw of *H. varians*.

The jaw is arched with acuminated ends, smooth anterior surface, and decided median prominence to cutting margin. Fig. 23 represents the jaw of *H. varians*. The lingual membrane (pl. XIII., fig. 1) has about 33—1—33 teeth, another specimen gave 43—1—43 teeth, with 17 perfect laterals. The central tooth has a long, narrow base of attachment with lower, outer angular expansions and incurved lower margin. The reflected portion is only about one-half the length of the base of attachment, is short, and bears one short, stout cusp with an equally short, stout cutting point; the side cusps and cutting points are obsolete. The laterals are the same as the centrals, but unsymmetrical. The outer laterals have a side cusp and cutting point. The marginals are low, wide, and have one broad, long, oblique, bluntly bifid cutting point, the inner division the smaller, and a very much shorter side cutting point. This side cutting point is also sometimes bluntly bifid in the extreme marginal teeth.

The dentition of the other species of this genus, extralimital to North America, examined by me, agrees with that of this species. (See Pr. Phila. Ac. N. S., 1874, 56.)

Genus **TEBENNOPHORUS**, Binn.

Fig. 24.

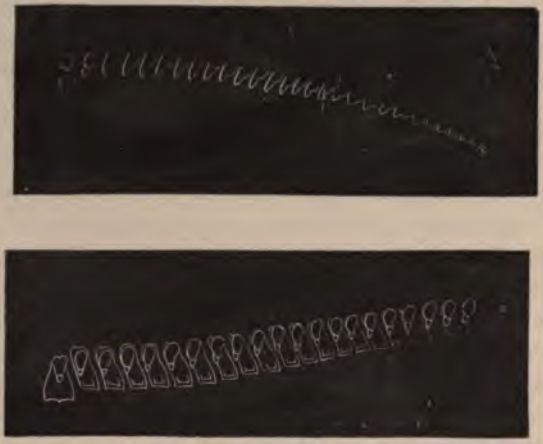


Jaw of *Tebennophorus caroliniensis*.

One species only is known to exist in North America, *T. Caroliniensis*. It has an arched jaw (fig. 24), with blunt, scarcely attenuated ends, ribless anterior surface, and decided blunt median projection to the cutting edge. The jaw is thick, coarse, with vertical and parallel transverse lines of reinforcement, but has no appearance of ribs. I have verified this fact by examining numerous specimens of all ages from various parts of the country. My observations have been confirmed by Morse, also (Journ. Portland Soc. N. H. 1864, 7). I am therefore inclined to doubt the identity of the specimen which Heynemann (Mal. Blatt. 1862, pl. III., fig. 12) describes with a ribbed jaw. Bergh (Zool. Bot. Gesell. in Wien, XX. 833) suggests that Heynemann may have had *Pallifera dorsalis* before him. Mörch, Journ. de Conch. 1865, suggests that it may have been *Veronicella Floridana.* At all events I do not believe it could have been the species now under consideration. I suspect it to have been *Pallifera Wetherbyi.* (See Ann. Lyc. Nat. Hist. of N. Y., XI. 31.)

The lingual membrane is arranged, as usual in the *Helicinæ*, as shown in fig. 25. It must be borne in mind that I offer this figure simply to show the general arrangement of the teeth—the form of the individual teeth being much more accurately given in pl. VI., fig 1. Morse counted 115 rows of 56—1—56 teeth, another membrane gave 49—1—49 teeth, with 22 perfect laterals; I have myself counted 56—1—56 teeth, with 11 perfect laterals. The central teeth *a* have a very long narrow base of attachment widening towards the lower margin, which is excavated. There is a line of reinforcement running parallel to the lower edge, and for a short distance along the sides. The reflected portion equals only one-fourth of the length of the base of attachment. It is stout

Fig. 25.



T. Caroliniensis. (Morse.)

and bears a short, stout, median cusp, having a short, blunt, cutting point. There are no side cusps or cutting points.

The laterals *b* are like the centrals, but unsymmetrical; their reflected portion is also longer. The outer laterals (*e*) have an outer side cusp.

The marginals *d* are a simple modification of the laterals, being quadrate, longer than wide, with one inner broad, long, oblique, bluntly pointed cutting point, bearing an inner, side, short, acute cutting point. These cutting points on the extreme marginals *e* are simply short and bluntly rounded.

Some membranes examined by me seemed to have an extension to the base of attachment beyond the upper margin of the reflected portion, to which it was parallel.

This membrane is peculiar in the long, narrow base of attachment and short reflected portion of the central and first lateral teeth.

Genus **HOLOSPIRA**, Mart. & Alb.

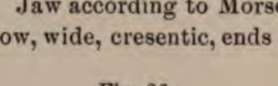
There are two species of this genus found within our limits, *H. Goldfussi* and *Roemeri*, the former of which I have been able to examine. I have not been able to examine lingual membrane of *H. Rœmeri*, but, thanks to Mr. Bland, I have examined and here figure (pl. XX., fig. 10) that of *H. Goldfussi.* There are 26—1—26 teeth, with about 9 laterals. The cusps of the marginals are quite widely separated. The general characters of the teeth are as described below. I can refer also to Messrs. Fischer and Crosse for information regarding the jaw and dentition (Journ. de Conch. XVIII. 13, 1870, pl. V., and Moll. Mex. et Guat., 320, pl. XVI.) The jaw is arcuate, with slighly acuminated, blunt ends, thin, anterior surface ribless; cutting edge simple; transversely and vertically striated.

The lingual membrane in *H. Tryoni* and *Pfeifferi* examined and figured by those authors, is of the usual *Helicinæ* type. The centrals and laterals have a single short cusp, bearing a short, blunt cutting point, both side cusps and side cutting points being absent; marginal teeth quadrate, wide, low, with one long, inner, obtuse cutting point, and one outer, side, short, blunt cutting point.

Genus **HELICODISCUS**, Morse.

Jaw according to Morse, of the only known species, *H. lineatus*, low, wide, cresentic, ends much attenuated, acute; cutting margin with a median, beak-like projection; anterior surface without ribs, but covered with striæ converging obliquely towards the beak-like prominence.

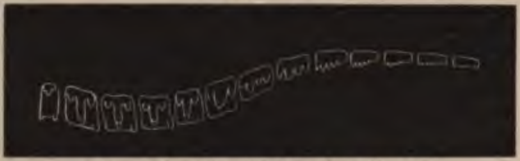
Fig. 26.



Jaw of *H. lineatus*. [Morse.]

According to my rule of admitting in the genus *Helix* only such species as have a ribbed jaw, I am forced to recognize *lineatus* as a distinct genus. Fig. 27 shows the general arrangement of the teeth upon the lingual membrane. The characters of the separate teeth are better shown in my plate XIII., fig. 5. Morse gives 77 rows of 12—1—12 teeth, each with 4 perfect laterals. Leidy, in Terr. Moll. U. S., II. 262, fig., gives 13—1—13 teeth, with 5 perfect laterals. The membrane examined by me has 12—1—12 teeth, with 4 perfect laterals. The central teeth have a base of attachment very small, longer than wide, with expanded lower angles, and reflected upper margin. Reflection very small, with a stout, short, median cusp, and very short, blunt side cusps, all the cusps with short cutting points. The lateral teeth have a base of attachment three times as wide, and somewhat longer than the centrals, and unsymmetrical by the suppression of the inner, lower lateral expansion; the upper margin is broadly reflected; the reflection is short but symmetrical, having two equally developed short, stout side cusps, bearing short cutting points; the median cusp is stout, long, extending nearly to the lower edge of the base of attachment, beyond which projects slightly the short cutting point.

Fig. 27.



Lingual dentition of *H. lineatus*. [Morse.]

The marginals are low and wide, the reflection as broad as the base of attachment, reaching nearly to its lower edge, and furnished with one inner, long, bluntly bifid, stout, oblique cutting point, and two or more short outer cutting points. The same form of marginal is found in *Pupa*.

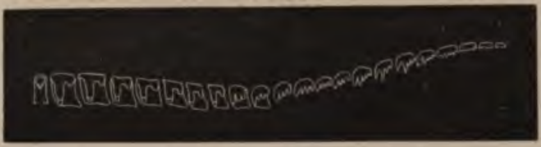
The membrane is very peculiar in the lateral teeth, not only from their large size, but also from their symmetrical, tricuspid reflection, quite like the usual arrangement of central teeth in the *Helicidæ*.

Genus **FERUSSACIA**, Risso.

The jaw (see pl. XVI., fig. 5 of that of the only species found in our limits, *F. subcylindrica*, Lin.) is low, slightly arcuate, wide, with but slightly attenuated, blunt ends; cutting edge with a slightly produced, wide, median projection; anterior surface without ribs, but with fine vertical striæ. There is a strong muscular attachment on its upper margin.

Figure 28 gives the general arrangement of the teeth, the characters of the separate teeth being better shown on pl. XV., fig. 9. This figure, as well as that of the jaw, I drew from a Maine specimen, furnished by Mr. Anson Allen. There were 24—1—24 teeth, with 8 perfect laterals. The central teeth are small and narrow in proportion to the laterals, with a long, narrow base of attachment, expanding at its lower angles. The reflected portion is very small, tricuspid; the central cusp stout, short; the side cusps small, blunt; all the cusps bear short cutting points.

Fig. 28.



F. subcylindrica.

The lateral teeth are about as wide as high in their base of attachment, which is subrectangular. The whole upper edge is squarely reflected. The reflection is very short, and bears a stout, blunt, long, inner cusp, reaching almost to the lower edge of the base of attachment, and bearing a long, blunt cutting point, which reaches beyond the lower edge. The outer side cusp of the reflection is widely separated from the inner cusp, is very short, bluntly rounded, and bears a short, blunt cutting point. The first marginals (fig. *b*) are but a modification of these laterals, by the greater development of the reflection, and shortening of the inner cusp. The outer marginals (fig. *c*) become wide, low, irregular in shape; the upper edge broadly reflected, the reflection reaching the lower edge of the base of attachment, and bearing along its whole length numerous (6 or 8 in some teeth) short subequal denticles, some bluntly rounded, others longer and sharp, giving a pectinate appearance.

My study of this membrane confirms my belief of the identity of the species with the European form. I have carefully compared the dentition of our form with that described and figured by Lehmann (Lebenden Schnecken, 132, pl. XIII., fig. 44), and find them to agree. I must, therefore, disagree with the decision of Morse (Journ. Portl. Soc.). I have also examined the genitalia of our species, and found it to agree with Lehmann's figure (l. c.), especially in the existence of the very peculiar flagellum to the penis sac. This, however, cannot be considered as a most reliable specific character peculiar to this species, as it exists also in *Cæcilianella acicula.*

I am very confident of the presence of well-developed side cusps to the central teeth, which Morse (l. c.) does not figure, though they are figured by Thomson, Ann. Mag. N. H., VII., pl. IV., fig. 8. They appear to me also to bear the short cutting points which I have figured.

Genus **CÆCILIANELLA**, Bourg.

I have not been able to examine the jaw or dentition of *C. acicula* (*Cionella acicula* of L. and Frw. Shells, I. 227), the only species found in our limits. They are both well known, however, from the descriptions and figures of Moquin-Tandon, Thomson, Sordelli,[1] and Lehmann. The jaw is low, wide, arcuate, with delicate vertical striæ. The lingual membrane (Lehmann, Lebenden Schnecken, p. 128, pl. XIII., fig. 43) has 120 rows of 11—1—11 teeth each. The centrals are small, tricuspid (Sordelli), the laterals, six in number, are larger, and have a more highly developed reflection, and are also distinctly tricuspid. Marginals subquadrate, with a broad reflection, bearing delicate denticles.

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[1] Sordelli (Atti della Soc. Italiana di Sc. Nat. XIII., fasc. 1, p. 50, pl. i. f. 25) describes the ribs to be not straight, but curving, with a median point projecting toward the end of the jaw, so that each rib resembles quite exactly the sign called "brace" by printers.

Genus **STENOGYRA**, Shuttl.

I have not been able to examine *S. octonoides* (*S. subula* of L. and Frw. Shells, I.) or *S. gracillima*, but only *S. decollata*, Lin., from Charleston,[1] S. C., a species introduced from Europe by commerce, and the true *S. subula* found near Mobile, Ala. Of extralimital species I have examined *S. octona*, *gonostoma*, and *hasta*. Semper has examined *S. Panayensis*.

The jaw (see pl. XVI., fig. 1, for that of *S. subula*) is low, wide, with attenuated, blunt ends, and a wide, slightly produced median projection. There are distinct vertical striæ on that of *S. decollata*.

The lingual membrane is long and narrow. The central tooth has a very small, high, narrow base of attachment, the lower outer angles generally somewhat expanded. The reflected portion is very small, and bears a short, stout, median cusp, and two very small side cusps; all the cusps bear distinct cutting points. The lateral teeth are very much larger than the centrals. The base of attachment is about as high as wide, its inner lower lateral expansion suppressed as usual. The upper edge is squarely reflected. The reflection is very large, and bears one stout median cusp, extending almost to the lower edge of the base of attachment; there is also an outer, much smaller side cusp, and a less developed, sometimes subobsolete inner side cusp; all the cusps have distinct cutting points, proportioned to their size; that on the central cusp being greatly developed. In *S. decollata* (pl. XV., fig. 5) the inner cutting point is also much developed, and joined to the central cutting point. The marginal teeth in *S. decollata* are but a modification of the laterals, with the suppression of the inner cusp and cutting point (*b*); the extreme marginals (*c*) differ in the greater development of the reflected portion and equalization with it of the cutting points, of which there are but two. In *S. subula* (pl. XV., fig. 8) the marginal teeth (*b*) have more numerous cutting points, formed by the bifurcation of the inner and outer cutting point. The second denticle from the inner side is the largest. It will be noticed that in *S. decollata* both the side cutting points of the laterals are quite thorn-shaped.

S. decollata, L. (pl. XV., fig. 5, *b* is one of the first marginals,

---

[1] I found the species in great numbers at various localities in this city during a recent visit (1875).

c extreme marginal)—a Charleston specimen. There are 38—1—38 teeth, with 11 perfect laterals.

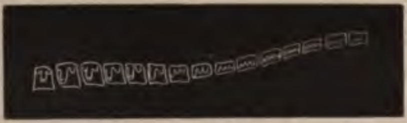
S. subula, Pfr. (pl. XV., fig. 8, *b* is an extreme marginal). There are 24—1—24 teeth, with 6 perfect laterals.

Genus **PUPA**, Drap.

I have personally examined the jaw and lingual membrane in only two species, *P. fallax* (pl. XV., fig 12) and *P. rupicola* (pl. XV., fig. 2). For information about the other species I am indebted to Mr. Morse, whose figures are copied below.

The jaw is low (in *P. rupicola*, pl. XVI., fig. 7, strongly arched), wide, arcuate; ends but little attenuated in *muscorum*, *pentodon*, *fallax*, *rupicola;* acutely pointed in *corticaria;* a more or less developed, broad, blunt median projection to the cutting edge; anterior surface without ribs, but generally with vertical striæ.

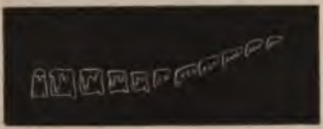
Fig. 29.



P. muscorum. [Morse.]

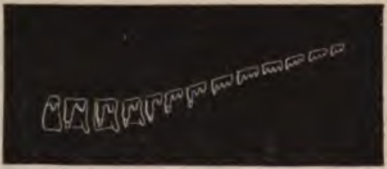
Figure 29 gives a general view of the arrangement of the teeth on the lingual membrane. Pl. XV., fig. 2, shows more correctly the characters of the individual teeth of the genus. The membrane is long and narrow, the teeth are as in the genus *Vertigo* described below; excepting that in *Pupa* the central tooth is quite small in proportion to the laterals. The marginal teeth are irregularly denticulated, the inner denticle the largest.

Fig. 30.



Lingual dentition of *Pupa pentodon.* [Morse.]

Fig. 31.



Lingual dentition of *Pupa corticaria.* [Morse.]

P. muscorum (see fig. 29 above), has 90 rows of 14—1—14 teeth, with six perfect laterals. The figure and description of Lehmann of the European *P. muscorum*, confirm my belief in the identity of the two forms.

P. Blandi, *Hoppii*, *variolosa*, *decora*, *corpulenta*, *Rowelli*, *Californica*, *modica*, *Arizonensis*, *hordeacea*, *armifera*, *borealis*, *contracta*, and *pellucida*, not examined.

P. pentodon has 64 rows of 10—1—10 teeth, with 4 perfect laterals (fig. 30).

P. corticaria has 12—1—12 teeth, with 3 perfect laterals (fig. 31).

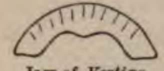
P. rupicola (pl. XV., fig. 2) has 11—1—11 teeth, with 5 perfect laterals.

P. fallax (pl. XV., fig. 12) has 15—1—15, with 7 perfect laterals.

Genus **VERTIGO**, Müll.

Jaw more or less arched, ends but little attenuated, blunt: anterior surface with delicate vertical striæ; cutting margin with a more or less developed median projection.

Fig. 32.

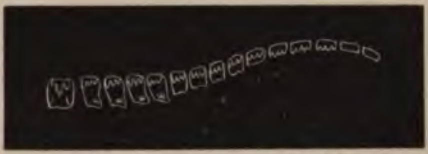


Jaw of *Vertigo ovata*. [Morse.]

I have given figure 32 copied from that of Morse. In the L. and Frw. Shells N. A., I., will be found other figures of jaws showing the variations in outline found in the genus. I have personally examined the jaw in none of our species.

For the characters of the lingual dentition I am also entirely dependent on Morse.

Fig. 33.

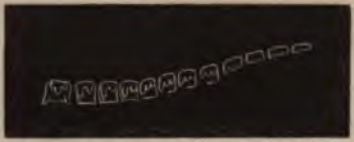


Lingual dentition of *Vertigo ovata*. [Morse.]

Figure 33 shows the general arrangement of the teeth on the membrane. The membrane is long and narrow. The central teeth have a base of attachment higher than wide, subrectangular. The whole upper margin is broadly reflected. The reflection is very short, and bears three short stout cusps, the central the longest, each cusp bearing (I presume) a distinct cutting point. The central tooth, in those species whose dentition is known to me, is as large as the laterals, and not smaller, as seems to be the rule in our species of *Pupa*. The lateral teeth are like the centrals, but unsymmetrical. The reflected portion is small, tricuspid or bicuspid. The marginals are wide, low, with a broad, irregular, denticulated reflection. Mr. Morse gives the following count of the teeth. *V. Gouldi* (fig. 34) has 75 rows of 11—1—11 teeth, with 7 perfect laterals. *V. Bolle-*

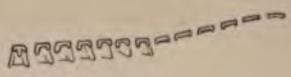
siana (fig. 35) has 88 rows of 12—1—12 teeth, with 6 perfect laterals. A comparison of this description and figure with that of Lehmann, pl. XIV., fig. 53, will prove that this species cannot be identical with *P. pygmæa* of Europe, as has been suggested by Mr. Gwyn Jeffreys (Ann. Mag. Nat. Hist., 1872, 246).

Fig. 34.



Lingual dentition of *Vertigo Gouldi*. [Morse.]

Fig. 35.



Lingual membrane of *Vertigo Bollesiana*. [Morse.]

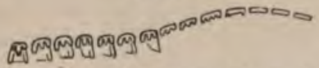
V. milium, not observed.

V. ovata (see above figure 33) has 90 rows of 14—1—14 teeth apparently with 9 perfect laterals. The species has been referred to *P. antivergo*, but the figure of the dentition of that species given by Lehmann (pl. XIV., fig. 52) does not sustain the theory of identity.

V. ventricosa has 98 rows of 13—1—13 teeth, with 6 perfect laterals (fig. 36).

V. simplex, not observed.

Fig. 36.

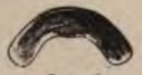


Lingual membrane of *Vertigo ventricosa*. [Morse.]

Genus **STROPHIA**, Albers.

But one species, *S. incana*, Binn., is found within our limits. I have found it to agree in the characters of its jaw and lingual membrane with the extralimital species which I have examined, *S. iostoma*, *mumia*, and *decumana*. Semper, however (Phil. Arch. 128), describes the jaw of *S. uva* as being without median projection to its cutting edge; that character, therefore, cannot be considered generic.

Fig. 37.

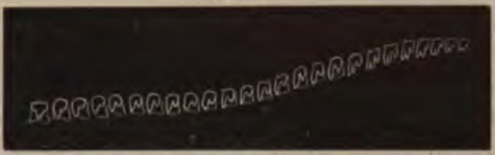


Jaw of *S. incana*.

Jaw of *S. incana* (fig. 37) arcuate, thick, coarse, of about equal height to its bluntly truncated ends: cutting edge with a slightly produced median projection. Anterior surface without ribs.

Fig. 38 shows the general arrangement of the teeth upon the lingual membrane. I regret not being able to give more accurately the characters of the individual teeth,[1] but have lost the membrane in removing it for examination. There are 129 rows of 24—1—24 teeth each. See Proc. Ac. Nat. Sc. Phila., 1874, pl. VIII., fig. 1, for figure of dentition of *S. decumana*.

Fig. 38.



Lingual dentition of *S. incana*.

(2) Jaw with decided short, vertical ribs to its anterior surface.

Genus **ARION**, Fér.

I have not been able to give any information regarding two species found within our limits, *A. Andersoni* (see below, p. 194), and *A. foliolatus*. Indeed there seems so much uncertainty in regard to them, that I doubt their belonging to this genus. For fuller information, see Ann. N. Y. Lyc. of N. H., X. 297. This leaves only one species, *A. hortensis*, Fér., described and figured in Terr. Moll. U. S., and in L. and Frw. Sh. N. A., I., referred to *A. fuscus*, Müll.

The species was introduced by commerce into Boston many years ago. It still exists there,[2] specimens having been found by me in 1871, from one of which I extracted the jaw and lingual membrane here described. I have compared the figures of the genitalia of *A. hortensis* given by Lehmann and A. Schmidt[3] with those given by Leidy in Terr. Moll. U. S. There is a difference in the position of the retractor muscle of the penis. Leidy places it at the base of the penis sac, Lehmann at the top, Schmidt omitting it entirely. The last two authors figure a retractor to the duct of the genital bladder, and so does Leidy (though in the description of the plates he refers it to the vagina). Lehmann figures a retractor also to the genital bladder itself. Lehmann's figure of the genitalia of *A. fuscus* (pl. VI., fig. 2) agrees more closely with Leidy's figure in all respects, indeed, but the position of the retractor penis, which Lehmann places at the top of the penis sac. His figure of the dentition of *fuscus* is nearer mine of the Boston specimens than is his of *hortensis*, though the transverse count of teeth is larger. Goldfuss' figure of the dentition of *A. hortensis* also (l. c. pl. V., fig. 6) differs from my figure in the same way, *i. e.*, by the presence of an inner side cusp and cutting point to the lateral teeth. Thus I find it impossible to decide from the genitalia whether to refer our species to *fuscus* or *hortensis*, though I incline to the former. From the dentition I should assuredly adopt the former name also.

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[1] Too late for illustration in the text, I have received specimens collected by Mr. W. W. Colkett at Key West. There are 27—1—27 teeth, of the same type as in *P. decumana*, referred to in the text.

[2] Specimens can readily be found in gardens between Chestnut and Mt. Vernon Streets above Willow Street, as well as elsewhere.

[3] Der Geschlechtsapparat der Stylommatophoren, 1855.

The jaw of the Boston specimen (pl. XVI., fig. 2) is thick, arcuate, ends but little attenuated; no median projection to the cutting edge: anterior surface with 8 stout, separated, unequal ribs, denticulating either margin.

Lingual membrane (pl. V., fig. 5) long and narrow. Teeth about 31—1—31, with about ten perfect laterals. Centrals with the base of attachment longer than wide: reflection half as long as the base of attachment, bearing one long, stout cusp extending to the lower margin of the base of attachment, beyond which projects the stout cutting point: side cusps distinct, but small, with distinct, small, stout cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment, and the inner side cusp and cutting point. The marginals are low, wide, with one long, bluntly pointed, oblique cutting point, bearing a subobsolete smaller point low down upon its outer side. This subobsolete side cutting point is on some of the marginals much more developed.

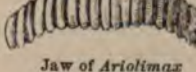
My figure *a* shows one central with its adjacent lateral, and *b* and *c* marginals, the latter form near the outer margin of the membrane.

From the above remarks it will be seen that in this genus, as in *Limax*, *Zonites*, and others, the lateral teeth are either bicuspid or tricuspid. The number of cusps does not seem a generic character.

Genus **ARIOLIMAX**, Mörch.

Jaw thick, slightly arcuate, ends but little attenuated, blunt; low, wide: anterior surface with numerous stout ribs, denticulating either margin. The number of ribs varies in the several species, and in different individuals of the same species. Fig. 39, drawn from the true northern *A. Columbianus*, has 18 ribs; another specimen, supposed to be the same species, has about 12. (See Proc. Ac. Nat. Sc. Phila. 1874, pl. II., fig. 11.) *A. Californicus* has given 13 and 14 ribs. *A. niger* has been described by Dr. Cooper with 20, but I found only 8 in one specimen which I refer to that species.

Fig. 39.



Jaw of *Ariolimax Columbianus.*

Fig. 498 of p. 279, L. and Frw. Shells N. A., I, gives the general arrangement of the teeth upon the lingual membrane. It is drawn from the true northern *A. Columbianus*. On pl. V., fig. 6, I have given more detailed figures of the dentition of a specimen I refer to this species. It will be seen that the central teeth have a base of attachment longer than wide, with expanded lower angles, and incurved lower margin; the upper margin is reflected; the reflection is large, broad, and has a short, stout median cusp, bearing a long, stout cutting point; the side cusps of the reflection are subobsolete, but there are well-developed triangular cutting points. The laterals are like the centrals, but unsymmetrical by the suppression of the inner lower lateral expansion to the base of attachment, and the inner side cutting point, the inner side cusps being still subobsolete.

The change from lateral to marginal teeth is shown in *b* and *c*, the median cusps and cutting point being greatly developed, and sometimes (*c*) having a side cusp and cutting point; the base of attachment is still narrower than in the first laterals. The marginals are shown in *d* and *e*. They are about as high as wide, the reflection equals the base of attachment and bears an extremely long, blunt, stout, oblique cutting point, with a side spur upon the last, in the extreme marginals developed into a short, stout, side cutting point. The cutting point of the marginals by its great development forms the chief characteristic of the membrane; it is well shown in profile (fig. *f*.). There were 22 perfect laterals in this specimen. The figure referred to above shows only 12 laterals, with 113 rows of 56—1—56 teeth each.

Ariolimax Californicus (pl. V., fig. 1) has the same type of dentition, but the bases of attachment are more developed, and are produced beyond the reflection at their upper margin. There are 80—1—80 teeth, with 9 perfect laterals.

Ariolimax niger, also (pl. V., fig. 3), has the same type of dentition as *A. Columbianus*, the side cusps of the centrals are, however, more developed. On one specimen I found marginal teeth with one inner stout, short, rounded cutting point, and two shorter, rounded, side cutting points (see fig. 2), instead of the usual long cutting point. This is the only variation in the dentition of the genus which I have noticed.

Since the above was written, I have received specimens which agree with Cooper's description of *Arion Andersoni*, which appear to be a true *Ariolimax*. Full descriptions will be given at another time. The jaw has 13 ribs. The lingual membrane has 48—1—48 teeth of the type usual in the genus.

Ariolimax Hemphilli, a species from Niles Station, Alameda County, California, which I am about to describe under the name of its discoverer, has a jaw with 8–12 ribs. Lingual membrane with 31—1—31 teeth of the type common to the genus.

For full remarks on this genus, see Proc. Ac. Nat. Sc. Phila. 1874, p. 33.

The genus, as far as now known, is restricted to this country; there are, therefore, no descriptions or figures of the jaw and dentition of foreign species to compare with ours.

Genus PROPHYSAON, Bl. and Binn.

Jaw of the single species known, *P. Hemphilli*, thick, low, wide, slightly arcuate, with but little attenuated ends, cutting margin without median projection; anterior surface with fifteen stout, irregularly developed, separated ribs, denticulating either margin (pl. XVI., fig. 9).

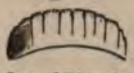
Lingual membrane (pl. V., fig. 4) long and narrow. Teeth about 40—1—40, with 16 perfect laterals. Centrals with a base of attachment longer than wide, reflection extending less than one-half the length of the base, with a very stout, short median cusp, bearing a stout, short, blunt cutting point, and on either side a subobsolete cusp bearing a stout, bluntly rounded, short cutting point. Laterals like the centrals, but unsymmetrical, as usual, by the suppression of the inner side cutting point and inner lower, lateral expansion of the base of attachment. Marginals (*b*) low, wide, with one inner, stout, oblique cutting point and two outer, smaller, blunt cutting points.

As in all lingual membranes, there is a difference in the development of the cusps and cutting points on various parts. The teeth figured are the least graceful in their outlines.

Genus **BINNEIA**, J. G. Coop.

Jaw (fig. 40) low, arcuate, with blunt, scarcely attenuated ends; no median projections to the cutting edge; anterior surface with numerous, broad, crowded ribs.

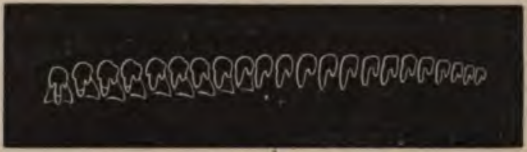
Fig. 40.



Jaw of *Binneia notabilis.*

Lingual membrane (fig. 41) as usual in the *Helicinæ*. Centrals with a subquadrate base of attachment, with expanded lower angles; upper margin reflected; reflection large, bearing three distinct cusps, the central the longest; all three cusps apparently with distinct cutting points. Laterals like the centrals but unsymmetrical by the suppression of the inner cusp and cutting point, and inner lower lateral expansion of the base of attachment. Marginals simply a modification of the centrals, subquadrate, higher than wide, with one inner, long, oblique, stout cutting point, and one outer, smaller, side cutting point.

Fig. 41.



Lingual membrane of *Binneia notabilis.*

I regret not being able to give a more satisfactory figure of the dentition of *B. notabilis*, our only known species.

It has 21—1—21 teeth, with 8 perfect laterals.

Genus **HEMPHILLIA**, Bl. and Binn.

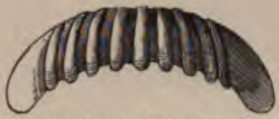
Jaw of the only known species, *H. glandulosa*, thick, low, wide, slightly arcuate, ends attenuated, blunt; cutting margin without median projection; anterior surface with about 14 crowded, stout, irregularly developed ribs, denticulating either margin (pl. XVI., fig. 6).

Lingual membrane (pl. V., fig. 7) long and narrow. Teeth 23—1—23, with 11 perfect laterals. Centrals with a quadrangular base of attachment, higher than wide. Reflection about half as long as this base, with a long, narrow median cusp reaching the lower margin of the base of attachment, beyond which projects slightly the short cutting point; side cusps but little developed, but bearing short, stout triangular cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. First marginal (*b*) with a square base of attachment, broadly reflected into one stout cusp, bearing a single, stout, very long, bluntly ending, oblique cutting point. Outer marginals (*c*) low, wide, the reflection broad, reaching the lower edge of the base of attachment, and bearing one inner, long, oblique, blunt cutting point; there appear no outer, small, side cutting points.

Genus **PALLIFERA**, Morse.

Jaw stout, arcuate, ends but little attenuated, blunt: anterior surface with stout separated ribs, 9 in *P. dorsalis* (fig. 42), over 15 in *P. Wetherbyi*. The jaw of the latter is arched, and has a blunt median projection, broken by the ends of the ribs. These last are more irregularly developed also.

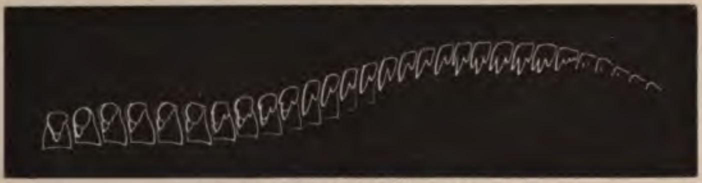
Fig. 42.



Jaw of *Tebennophorus dorsalis!*

Fig. 43 shows the arrangement of the teeth on the membrane in *P. dorsalis*, while separate teeth of the same species are more correctly drawn on pl. VI., fig. C.

Fig. 43.



Lingual dentition of *Pallifera dorsalis.*

Mr. Morse gives 115 rows of 56—1—56 teeth each, with 13 perfect laterals. In the specimen examined by me I found only 29—1—29 teeth, with 14 perfect laterals, a difference sufficiently great to raise a doubt of the specific identity of the two specimens. The central teeth have a base of attachment longer than wide, with short lines of reinforcement running parallel to the outer edges at the lower margin. The upper margin is reflected. The reflection extends about one-third of the length of the base of attachment; it bears a central, stout, well-developed cusp, and one small, little-developed, rounded cusp at each side; all three cusps have stout cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner cusp and cutting point, and inner, lower, lateral expansion of the base of attachment. The marginal teeth are low, wide; broadly reflected, the reflection equalling the length of the base of attachment, and very irregularly denticulated, there being usually one long, blunt, oblique, inner, bifid cutting point, the outer division much the shorter, and several short, blunt, outer cutting points.

P. Wetherbyi (pl. VI., fig. B), the only other species now known, has 35—1—35 teeth, with 13 perfect laterals. The teeth are different from those of *P. dorsalis*, and nearer those of *Tebennophorus Caroliniensis*. The side cusps of the centrals and laterals are subobsolete, and have no distinct cutting points, the median cusp is much more produced, stouter, and bears a stout, blunt, cutting point. The marginal teeth are not so wide, they are less irregularly denticulated, having usually one long, stout, blunt, oblique, inner cutting point, and one shorter side cutting point.

Genus **HELIX**, Lin.

In common with all who have studied the genus *Helix*, I am convinced of the necessity of recognizing among its species numerous distinct genera. I have, however, at this time eliminated those species only whose jaw has no distinct ribs upon its anterior surface.[1] The balance of the species I retain grouped as subgenera[2] only. Before recognizing these groups as distinct genera, I desire to wait until we can ascertain whether generic characters can be found in the jaws and lingual dentition as well as in the shells. I shall discuss the constancy of these characters under each group, as far as our material will allow. In this place I will merely mention that in general terms it may be said that *Pomatia*, *Tachea*, *Euparypha*, *Arionta*, and *Aglaja* have few, separated ribs, usually grouped near the centre of the jaw, leaving both extremities without ribs. *Mesodon*, *Triodopsis*, and *Polygyra* have numerous, separated ribs spread over the whole of the jaw. *Stenotrema* has numerous stout, crowded ribs also spread over the whole surface of the jaw. The ribs are also numerous, crowded, and similarly disposed in *Strobila*, *Gonostoma*, *Dorcasia*, and *Fruticicola*, but they do not so deeply denticulate both margins as in the genera mentioned above. All the above have a high jaw. The following have a much lower jaw: *Vallonia*, with numerous crowded ribs slightly denticulating the margins, especially the lower one; *Acanthinula*, with similar ribs, but quite arched; *Glyptostoma*, with still more numerous, separated ribs, deeply denticulating either margin; and *Polygyrella*, with more numerous ribs, and proportionally much wider to its height than in any of the other North American subgenera. Thus there seems to be some distinctive subgeneric character to the jaw. It must, however, be borne in mind that there are exceptions in some of the subgenera where the species are numerous; thus, in *Arionta*, I found numerous ribs in *ruficincta*, though the other species have but few. The number, disposition, and size of the ribs vary within certain limits in different individuals of the same species. I have repeatedly found this to be the case.

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[1] I fear that even this rule will not hold good. In some subgenera of *Helix* the absence or presence of ribs on the jaw is not a reliable character. For instance, in *Dentellaria* we have found the jaw of *H. Josephinæ* and *formosa* without ribs. *H. dentiens*, *badia*, *pachygastra* are heavily ribbed. *H. lychnuchus*, *nucleola*, and *perplexa* less so.

[2] In the list of species given above (p. 152), I have used only the subgeneric names.

In regard to the subgeneric value of the type of lingual dentition, I can only say in general terms that within certain limits it may prove reliable. Here again, however, we find the type of dentition inconstant when many species are known. Thus in *Arionta* we find *Townsendiana* (pl. XVIII., fig. 8) quite differing from the other known species (see below). In *Mesodon*, also (pl. XII.), I find two quite distinct types of dentition, and under each subgenus I have pointed out the variation observed. I am convinced that the presence or absence of side cusps to central and lateral teeth is not a reliable subgeneric character. The marginal teeth offer more reliable characters. They are very peculiar in *Vallonia* and *Strobila*, in being very low and wide, and having numerous cutting points, quite resembling those of *Pupa*.

In *Mesodon*, *Triodopsis*, and *Arionta*, the marginals are longer than wide, with only two, sometimes bifid cutting points. In *Stenotrema* and *Polygyra* they are rather wider than long, also with two more bluntly bifid cutting points. It must be borne in mind, however, that my observations have not led me to believe these characters sufficiently constant to be of subgeneric value. I prefer to wait till more species have been examined. There is also some variation in the mode of passing from lateral to marginal teeth, even in the same subgenus. These points will be treated more fully under each subgenus.

Subgenus GONOSTOMA.

This subgenus is represented in our limits by one species only, *H. Yatesi*, J. G. Cooper, not Pfr., whose jaw and lingual membrane are here described. Jaw (pl. XVI., fig. 10) low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with a strong transverse line of reinforcement, and numerous, about 12, wide, crowded ribs denticulating either margin.

Lingual membrane (pl. IX., fig. 3) long and narrow; teeth 24—1—24, with 6 perfect laterals. Centrals with the base of attachment longer than wide, with expanding lower lateral angles, and squarely reflected upper margin; reflection large, stout, bearing small but distinct side cusps, with short, blunt cutting points, and a long, stout, median cusp reaching the lower edge of the base of attachment, beyond which projects the long, acute cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the distinct inner side cusp and cutting point. Marginals subquadrate (*b*), a simple modification of the laterals, the reflection being more developed, and bearing one inner, oblique, long, blunt cutting point, and one smaller side cutting point; the extreme marginals (*c*) are rather wider than high, and the cutting points are bluntly rounded.

The name *Yatesi* being already preoccupied in the genus *Helix*, Dr. Cooper's species may be known as *Yatesiana*.

Von Martens describes the jaw of *Gonostoma* as having distinct ribs. Moquin-Tandon so figures that of *obvoluta*, Müll, *lenticula*, Fér, and *Rangiana*, Fér; and Gassies (Journ. de Conch., XV., 1867, 15) so describes that of *H. constricta*, B.

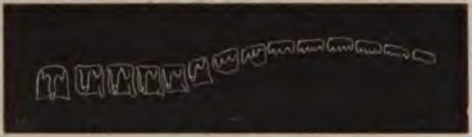
The lingual membrane of *obvoluta* is described by Goldfuss (l. c. 45) with a type of central teeth differing from that I have shown in *Yatesi*.

Subgenus Strobila.

Jaw low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with (over 12 in *labyrinthica*, numerous in *Hubbardi*) crowded ribs, denticulating either margin, and more developed on the centre of the jaw.

Lingual membrane of *labyrinthica* long and narrow, with 78 rows of 13—1—13 teeth each, with 5 perfect laterals. Morse figures 6 laterals. Centrals with a base of attachment about square, upper edge broadly reflected; reflection very short, bearing a long, slender, median cusp reaching the lower edge of the base of attachment, with a short cutting point extending slightly beyond it; side cusps very small, each bearing a short cutting point. Lateral teeth like the centrals, but unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the inner side cusp and side cutting point. Outer laterals gradually changing into the marginals, which are low, wide, with a reflection equalling the base of attachment, and furnished with numerous (about 5) subequal, short cutting points, the inner one longest and bifid (pl. XVIII, fig. 7).

Fig. 44.



Lingual dentition of *Helix labyrinthica*. [Morse.]

Morse mentions no ribs on the anterior surface of the jaw, but they are well developed on the specimen examined by me.

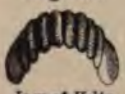
Helix Hubbardi, a specimen from Bonaventure Cemetery near Savannah, kindly opened by Mr. Bland, furnished a jaw and lingual membrane. Jaw long, low, slightly arcuate, ends acuminated; no median projection to cutting edge; anterior surface with numerous crowded ribs, denticulating either margin.

Lingual membrane with 14—1—14 teeth, 5 laterals. All the teeth like those of *H. labyrinthica* (pl. XVIII., fig. 11).

There are no known species foreign to North America, with which to compare the dentition and jaw of *labyrinthica* and *Hubbardi*.

Subgenus POLYGYRA.

Fig. 45.



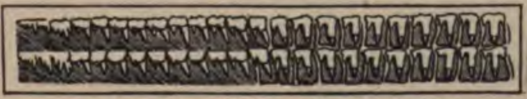
Jaw of *Helix ventrosula*.

Jaw high, arcuate, ends scarcely attenuated, blunt, cutting edge without median projection; anterior surface with numerous stout, separated ribs, denticulating either margin. I have counted 8 ribs in *H. ventrosula;* 14 in *pustula;* over 14 in *cereolus;* 10 in *espiloca;* 13 in *uvulifera;* 10 in Texasiana; 12 in *Troostiana;* 11 in *leporina;* 15 in *Mooreana;* 20 in *fastigans;* 7 in *septemvolva;* 10 in *Febigeri;* in *Hazardi*, *auriculata*, and *auriformis* they are also numerous. I have had no opportunity of examining the jaw in the other species found within our limits, *Postelliana*, *avara*, *Hindsi*, *triodontoides*, *tholus*, *hippocrepis*, *oppilata*, *Dorfeuilliana*, *Ariadnæ*, *cereolus* (see p. 203), *Carpenteriana* (see ib.), *pustuloides*.

By the character of its jaw, *Polygyra* can be compared only to *Triodopsis* and *Mesodon* among the other North American subgenera of *Helix*. No foreign species has yet been examined. The genus is almost exclusively North American, though several species have been described from the West Indies and Mexico, and one from Bolivia.

Fig. 46 shows the general arrangement of the teeth upon the lingual membrane, the characters of the individual teeth being better shown in my plate VIII. The teeth do not differ from what I have described under *Stenotrema* (see p. 205). As in all the subgenera, there is considerable difference in the length of the base of attachment on the central and lateral teeth in the several species.

Fig. 46.



Lingual dentition of *Helix auriformis?* [Leidy.]

The marginals are lower and wider (see pl. VIII., fig. 1, *d*) than in *Mesodon* and *Triodopsis*, but this character is not constant, the marginals of *auriculata* and *auriformis* being higher than wide. I find considerable difference also between the various species in the manner in which the lateral teeth pass into the marginals. In *auriformis*, *espiloca* and *Hazardi*, the change is made simply by the greater development of the inner cutting point, not by its bifurcation (see pl. VIII., fig. 5, *b*). In these species it is only the extreme outer marginals that have their inner cutting point bifid; in *H. auriformis* a very few extreme marginals have a bifid cutting point. This species and *H. auriculata* have very long inner cutting points to their marginal teeth (see fig. 9, *c* of pl. VIII.). In the other species examined by me the first marginals have their inner cutting point bifid, the transition from laterals to marginals being thus very distinctly marked. With these exceptions, the dentition of our species of *Polygyra* is very like that of *Stenotrema* (q. v.).

The dentition of no foreign species is known with which to compare our species.

The count of the teeth in the various species now follows:—

H. auriculata (pl. VIII., fig. 12) has 27—1—27 teeth with 12 laterals, 10 ribs on jaw.

H. uvulifera (pl. VIII., fig.) 23—1—23 with 8 laterals.

H. auriformis (pl. VIII., fig. 9) has 26—1—26 teeth, with 8 laterals. Fig. *c* shows the proportional greater development of the cutting point in the outer laterals.

H. Postelliana, Bland. Not examined.

H. espiloca, Rav. (pl. VIII., fig. 4) has 25—1—25 with 11 laterals.

H. avara. Not examined.

H. ventrosula (see L. and Frw. Shells N. A. I. p. 92, fig. 166), 93 rows of 24—1—24 with 9 laterals. I have not preserved this membrane, so cannot now correctly draw it.

H. Hindsi. Not examined.

H. Texasiana (pl. VIII., fig. 1) has 26—1—26 with 11 laterals.

H. triodontoides. Not examined.

H. Mooreana (pl. VIII., fig. 10) has 20—1—20 with 8 laterals.

H. tholus. Not examined.

H. hippocrepis. Not examined.

H. fastigans (pl. VIII., fig. 11) has 21—1—21 with 8 laterals.

H. Jacksoni. Not examined.

H. Troostiana (pl. VIII., fig. 2) has 25—1—25 teeth with 8 laterals. The marginals figured are from the portion of the membrane where they are the least developed as to their cutting points.

H. Hazardi (pl. VIII., fig. 5) has 16—1—16 teeth with 8 laterals.

H. oppilata. Not examined.

H. Dorfeuilliana. Not examined.

H. Ariadnæ. Not examined.

H. septemvolva (pl. VIII., fig. 6) has 9 laterals. I cannot count the teeth or draw the marginals on the only slide I have preserved. The latter were described by me as being like those of *fastigans.* After an opportunity of examining the true *septemvolva* at St. Augustine, I give a more detailed figure on pl. XX., fig. 5. There are 28—1—28 with 9 laterals. The small form with five whorls differs only in having somewhat fewer teeth. The form known as *H. volvoxis* does not differ excepting in having fewer marginals: Jacksonville, Fla., specimens have 20—1—20 teeth.

H. cereolus. Too late for illustration, I have received specimens collected at Key West by Mr. W. W. Calkins. There are 22—1—22 teeth, with 9 laterals all of same type as in *septemvolva.* 14 ribs on jaw.

H. Carpenteriana. 22—1—22 teeth, with 9 laterals, 12 ribs on jaw.

H. Febigeri (pl. VIII., fig. 7) has 17—1—17 teeth with 9 laterals.

H. pustula (pl. VIII., fig. 8) has 17—1—17 teeth with 8 laterals.

H. pustuloides. Not examined.

H. leporina. Too late for inserting in the plates, I have received through Mr. Bland, the jaw and lingual membrane of a Texas specimen furnished by Mr. A. G. Wetherby. The jaw has 11 ribs. There are 18—1—18 teeth, with 8 laterals, all of same type as in *H. fastigans.*

Subgenus POLYGYRELLA.

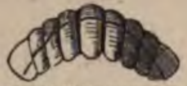
Jaw of the only known species, *Helix polygyrella* (pl. XVI., fig. 11) very low, wide, very slightly arcuate, ends very gradually attenuated: cutting margin without median projection: anterior surface with numerous (even 26), broad, slightly separated ribs, denticulating either margin.

Lingual membrane (pl. IX., fig. 2) long and narrow. Teeth 27—1—27, with 5 perfect laterals. Centrals subquadrate, the lower lateral angles but little expanded; the upper margin broadly reflected: reflection large, wide, with distinct, but small, rounded side cusps bearing short conical cutting points, and a very stout median cusp reaching the lower margin of the base of attachment, beyond which projects the short, stout, conical cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and the inner side cusp and cutting point. First marginals a simple modification of the laterals by the lesser development of the cutting point (*b*). Outer marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique cutting point, and two shorter outer blunt cutting points.

Polygyrella is quite distinct from all the other American subgenera of *Helix* by the form of its jaw and the large number of ribs upon its anterior surface.

Subgenus STENOTREMA.

Fig. 47.



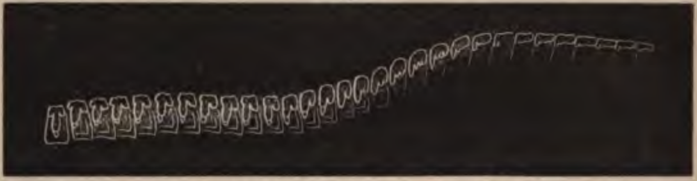
Jaw of *Helix monodon*. [Morse.]

Jaw thick, high, arched; ends but little acuminated, blunt; cutting margin without median projection; anterior surface with stout, broad, crowded ribs, denticulating either margin. There are about 8 in *stenotrema*, 11 in *germana*,[1] 7 in *monodon*, 8 in *hirsuta*, 13 in *Edvardsi*, 12 in *barbigera*, 8 in *spinosa*.

I have had no opportunity of examining *H. labrosa*, *Edgariana*, or *maxillata*.

The subgenus is restricted to North America as far as known. It differs from our other subgenera in having its ribs much broader and much more closely crowded.

Fig. 48.



Lingual dentition of *Helix monodon*. [Morse.]

Fig. 48, drawn by Mr. Morse, gives the general arrangement of the teeth on the lingual membrane. The characters of the individual teeth are more correctly shown in my figures on pl. IX.

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[1] See Ann. Lyc. N. H. N. Y., X. pl. XIV., fig. 4. Perhaps a *Mesodon*.

Centrals with a base of attachment longer than wide, the lower lateral angles but little expanded, the lower margin incurved, the upper margin squarely reflected; reflection large, wide, with small, in some species almost obsolete, side cusps, always bearing distinct, well developed cutting points; and a very stout median cusp, bearing a stout cutting point which usually projects beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of the inner lateral angle of the lower edge of the base of attachment and the inner side cusp and cutting point. The transition from laterals to marginals is shown in pl. IX., fig. 8 (*H. spinosa*). It is, as usual, produced by the comparative lesser development of the inner cusp and greater development of its cutting point. This cutting point becomes bifid, the reflection becomes shorter, the cutting points more produced, and thus gradually the form of the marginal teeth is reached. They are low, wide, the reflection equalling the base of attachment, the cutting points long, oblique, usually two in number, the inner one generally, and the outer one rarely, bluntly bifid: the outer bifurcation of each is more produced than the inner. There is great variation in the denticulation of the marginal teeth even on the same lingual membrane. A transition from laterals to marginals similar to that of *H. spinosa* is found in *H. barbigera*, *Edvardsi*, *stenotrema*, *hirsuta*, *germana*, and *monodon*.

There seems no difference in the characters of the teeth of the different species examined by me, excepting the slight one of the greater or lesser development of the side cusps of centrals and laterals, especially the former; whether this is constant can only be proved by a careful examination of every portion of each lingual. In *H. hirsuta* I found these cusps more developed than in the other species (pl. IX., fig. 6).

The count of the teeth in the different species is as follows:—

H. spinosa (pl. IX., fig. 8) has 27—1—27 teeth; 9 perfect laterals.

H. Edvardsi (pl. IX., fig. 1) has 20—1—20 teeth; 9 perfect laterals.

H. barbigera (pl. IX., fig. 9) has 21—1—21 teeth; 8 perfect laterals; but even the third has its inner cutting point greatly produced.

H. stenotrema (pl. IX., fig. 7) has 20—1—20 teeth; 10 perfect laterals.

H. hirsuta (pl. IX., fig. 6) has 22—1—22 teeth; 10 perfect laterals.

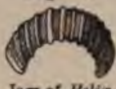
H. germana (pl. IX., fig. 5) has 28—1—28 teeth; 12 perfect laterals. Fig. 6 shows one of the few marginals which have the outer cusp bifid.

H. monodon (pl. IX., fig. 4) has 21—1—21 teeth; 10 perfect laterals. Morse gives 28—1—28 teeth.

H. labrosa, *maxillata*, and *Edgariana* not examined by me.

Subgenus TRIODOPSIS.

Fig. 49.



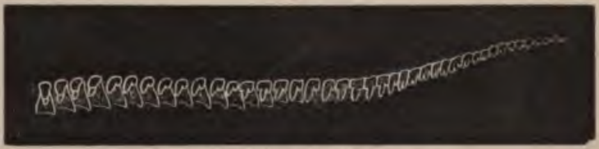
Jaw of *Helix appressa.*

Jaw stout, arcuate, low, wide, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous decided, separated ribs, denticulating either margin. There are about 15 in *palliata;* 10 in *obstricta;* 15 in *appressa;* 14 in *inflecta;* 10 in *Rugeli;* 14 in *fallax;* over 10 in *Hopetonensis;* over 12 in *Harfordiana;* 11 in *loricata*;[1] over 10 in *tridentata.* I have not examined *H. Mullani*[2] and *vultuosa.*

The subgenus is almost exclusively North American. Two Central American species have, however, been described, and one European species, *H. personata*, Lam. This last is said by Moquin-Tandon to have 3—5 separated ribs upon its jaw, while our American species, as shown above, have numerous ribs.

Triodopsis does not differ from *Mesodon* or *Polygyra* in the character of its jaw. *Stenotrema*, on the other hand, is readily distinguished by having the ribs broader and more crowded on its jaw.

Fig. 50.



Lingual dentition of *Helix appressa.*

The general arrangement of the teeth on the lingual membrane is shown in fig. 50. The characters of the individual teeth are given on pl X. I have selected *H. appressa* (fig. 7) to show these characters, comparing the dentition of the other species with it. The centrals are longer than wide; the base of attachment has its outer, lower, lateral expansion but little developed, its lower margin incurved, its upper margin squarely reflected; the reflection is stout, with subobsolete side cusps, but well-developed side cutting points, and a stout, short median cusp, bearing a cutting point which does not reach the lower margin of the base of attachment. The laterals are like the centrals, but, as usual in the genus *Helix*, unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp with its cutting point. The transition teeth are characterized by the gradual lesser proportional development of the reflection, and greater development of the inner cutting point; as the teeth pass outward, this point becomes bifid, the reflection becomes gradually shorter, until the true marginals are reached. These last are low, wide, the reflection equalling the base of attachment, the inner cutting point being greatly developed, long, oblique, bluntly bifid, the inner bifurcation the shorter of the two; the outer cusp is very short, blunt, sometimes also bifid. In fig. 7, the 10th is the first lateral showing decided modification; the 14th tooth has its inner point bifid; the 17th tooth is a decided marginal. The transition from laterals to marginals is so gradual that it is often difficult to give the number of perfect laterals. In many cases, therefore, the number given by me must be considered as only approximately correct. There is great variation in the denticulation of the marginal teeth.

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[1] The ribs are more crowded in this species.

[2] Probably identical with *devia.*

The general character of the dentition of the other species is about the same as in *appressa*. I found great difficulty in detecting the side cutting points in several species, especially *tridentata* and *palliata*. In some species I did not find the transition teeth or inner marginals with bifid cutting point (pl. X., fig. 3, 4).

I give below the count of the teeth in the several species.

H. palliata (pl. X., fig. 2) has 34—1—34 teeth; 12 perfect laterals; another specimen had 14 laterals. Morse counted 115 rows of teeth. The inner cutting point of the transition teeth in this species is very large, as shown in *c*.

H. obstricta (pl. XVIII., fig. 10) has 33—1—33 teeth; 10 perfect laterals: very like *H. palliata*. My figures are drawn from that part of the lingual membrane which has the cutting points of its teeth quite blunt. Other portions of the membrane would furnish much more sharply pointed teeth.

H. appressa (pl. X., fig. 7) has 33—1—33 teeth; about 12 perfect laterals.

H. inflecta (pl. X., fig. 4) has 22—1—22 teeth; 7 perfect laterals. This and the following species have inner marginal teeth with simple, not bifid, cutting points (*c*).

H. Rugeli (pl. X., fig. 3) has 21—1—21 teeth; 6 perfect laterals.

H. tridentata (pl. X., fig. 1) has 25—1—25 teeth; 10 perfect laterals. The inner cutting point is bifid after the 10th.

H. Mullani. The species is probably identical with *devia*.

H. Harfordiana has 26—1—26, with 12 laterals. Jaw with over 12 ribs. Received too late for illustration.

H. fallax (pl. X., fig. 5) has about 40—1—40 teeth; 14 laterals. This (not *tridentata*) had no bifurcation to the inner cutting point of the transition teeth, at least on the portion of the membrane examined by me.

H. introferens not examined by me.

H. Hopetonensis (pl. X., fig. 6) has 27—1—27 teeth as far as I can judge from an imperfect membrane. There are 7 perfect laterals.

H. vultuosa not examined.

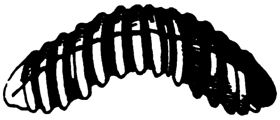
H. loricata (pl. XVIII., fig. 4) has over 20—1—20 teeth; 8 perfect laterals.

Helix personata is the only European species of this subgenus, but no figure of its dentition has been published to compare with that of our species. The same is true of the two Central American species known.

Subgenus MESODON.

Jaw stout, high, arcuate, wide, ends but little attenuated, blunt; no median projection to the cutting margin; anterior surface with numerous, separated, decided ribs, denticulating either margin. I have counted 13 in *H. major;* 10 in *albolabris;* 10 in *multilineata;* 11 in *Pennsylvanica;* 12 in *Mitchelliana;* 12 in *elevata;* 13 in *Clarki;* 13 in *exoleta;* 18 in *Wetherbyi:* 14 in *dentifera;*

Fig. 51.



Jaw of *Helix Sayii.* [Morse]

7 in *Roëmeri:* 13 in *thyroides:* 10 in *clausa:* 8 in *Columbiana:*[1] 7 in *devia:* 10 in *profunda:* 15 in *Sayii:* 10 in *Mobiliana:* over 10 in *Downieana.*

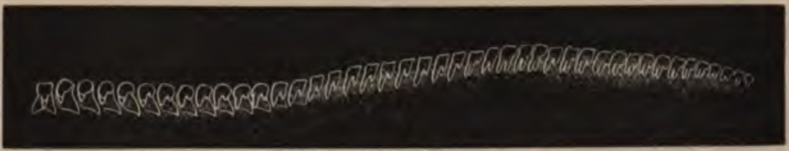
I have had no opportunity of examining *H. divesta*, *Christyi*, *Wheatleyi*, and *jejuna*.

Nothing has been published regarding the jaw and lingual dentition of the subgenus from species foreign to North America, as it is exclusively confined to this country.

The jaw of *Mesodon* does not essentially differ from that of *Triodopsis* and *Polygyra*, but may readily be distinguished from that of the other American subgenera.

The lingual membrane is long and narrow. The general arrangement of the teeth is shown in fig. 52. The characters of the individual teeth are better shown in my plates. It will be seen that there are two distinct types of dentition among the species of the subgenus. The first form of dentition is found in *albolabris* (pl. XI., fig. 1), *Roëmeri* (pl. XI., fig, 3), *Wetherbyi* (pl. XI., fig. 2), *Downieana* (pl. XI., fig. 4), *Sayii* (pl. XI., fig. 5) *exoleta* (pl. XI., fig. 7), *Pennsylvanica* (pl. XVIII., fig. 3), *Mitchelliana* (pl. XVIII., fig. 5), *elevata* (pl. XII., fig. 1), *Columbiana* (pl. XII., fig. 2), *Mobiliana* (pl. XII., fig. 3), *devia* (pl. XII., fig. 4), *profunda* (pl. XII., fig. 5) *multilineata* (pl. XII., fig. 6), *dentifera* (pl. XII., fig. 8), *Clarki* (pl. XI., fig. 6). Even among these species there are some important variations. Thus I have failed to detect any side cutting points on the subobsolete side cusps of the central and first lateral teeth of *Roëmeri*, *Wetherbyi*, *Downieana*, *Sayii*, *exoleta*, *Pennsylvanica*, and *Mitchelliana*. All these species have their side cusp less developed than in the other species mentioned above. The presence of the cutting point may be detected by better manipulation than I am able to give, but as far as my powers

Fig. 52.



Lingual dentition of *Helix multilineata*.

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[1] See Ann. N. Y. Lyc. of N. H., X. pl. XIV., fig. 2.

go, I cannot find it. The outer laterals, however, in most of the species have a much more developed side cusp than the inner laterals, bearing a well-developed cutting point (see pl. XI., fig. 6, *d*), but not all the species, as *H. exoleta* for instance, as shown in pl. XI., fig. 7, *d*, has no well developed side cusp and cutting point on its outer laterals, nor does it appear except on the decided marginals. It is the same in *H. Sayii*.

I find also variation in the manner of passing from the lateral to the marginal teeth among the species of this first group of *Mesodon*. In *H. exoleta* (pl. XI., fig. 7, 14) the cutting point remains the same, and also in *Sayii*, *profunda*, *Wetherbyi*, and *Mitchelliana*, but in *elevata* (pl. XII., fig. 1, 18) the transition teeth are characterized by the bifurcation of the large cutting point; the same occurs in *albolabris*, *multilineata*, *Roëmeri*, *Columbiana* (pl. XII., fig. 2) and *devia*, and the rest of the group.

The general character of the teeth in this section of *Mesodon* is about the same as I have described above for *Triodopsis* (p. 260). It will be noticed, however, that the marginals (as in *H. exoleta* and *Wetherbyi*) do not always have their cutting points bifid.

The other type of dentition in the subgenus *Mesodon* is shared by *H. thyroides* (pl. XVIII., fig. 2), *clausa* (pl. XII., fig. 7), and *Wheatleyi* (pl. XVIII., fig. 1). The centrals and first laterals have subobsolete side cusps without cutting points, the outer laterals have no side cusp, but retain the type of the first laterals, they are much longer, narrower, and have one extremely long, oblique, stout, bluntly pointed cutting point, reaching far beyond the lower margin of the base of attachment. These outer laterals pass gradually into the marginals, which retain their general form but have a less developed reflection, and much more proportionally developed cutting point, sometimes bifid in the extreme marginals (pl. XVIII., fig. 2, 54), and usually with a small side cutting point.

As in all the subgenera of *Helix*, the marginal teeth of *Mesodon* show great variation in their denticulation, even in most cases on the same membrane. *H. Clarki* (pl. XI., fig. 6) has the marginals with cutting points much blunter and broader in some parts than in the others.

The study of the dentition of *Mesodon* shows that we must be prepared to find considerable variation in the character of the teeth of any subgenus. The peculiar outer lateral teeth and marginals of *H. thyroides*, for instance, would hardly have been expected, so utterly different are they from those of *albolabris*. Again, we should hardly have expected to find such a difference in the same subgenus, as the presence and absence of side cutting points on the central and first lateral teeth.

I will now give the count of teeth in the several species.

Helix major, not examined.

Helix albolabris (pl. XI., fig. 1). Outer laterals have distinct side cusps as well as cutting points. Teeth 44—1—44, with about 12 laterals. The inner cutting points of fig. *b* should be bifid.

Helix divesta, not examined.

Helix multilineata (pl. XII., fig. 6), 42—1—42 ; 12 laterals.

Helix Pennsylvanica (pl. XVIII., fig. 3), 40—1—40 ; 13 perfect laterals. Morse counted 120 rows of 39—1—39 teeth.

Helix Mitchelliana (pl. XVIII., fig. 5), 49—1—49 ; 18 laterals. Outer laterals have side cusps and cutting points.

Helix elevata (pl. XII., fig. 1), about 45—1—45 ; 17 laterals.

Helix Clarki (pl. XI., fig. 6), 35—1—35, with 15 laterals.

Helix Christyi, not examined.

Helix exoleta (pl. XI., fig. 7) has 56—1—56 ; 11 perfect laterals, but even the 8th tooth shows a decided modification in form.

Helix Wetherbyi (pl. XI., fig. 2) has 35—1—35 ; 12 laterals.

Helix Wheatleyi (pl. XVIII., fig. 1) has 67—1—67, with over 12 laterals.

Helix dentifera (pl. XII., fig. 8) has 32—1—32 teeth, with 15 laterals.

Helix Roëmeri (pl. XI., fig. 3) has 35—1—35 teeth, with 12 laterals.

Helix thyroides (pl. XVIII., fig. 2) has 60—1—60, with 11 laterals.

Helix clausa (pl. XII., fig. 7) has 41—1—41, with about 11 perfect laterals.

Helix Columbiana (pl. XII., fig. 2) has 33—1—33 teeth ; 15 perfect laterals.

Helix Downieana (pl. XI., fig. 4) has 35—1—35 teeth, with 12 laterals. The side cusps and cutting points are visible on the second lateral tooth.

Helix Lawi, not observed.

Helix Mobiliana. The true species, from Baldwin County, Alabama, Dr. E. R. Showalter (pl. XII., fig. 3). There are 25—1—25 teeth, with 10 perfect laterals.

Helix jejuna, not examined.

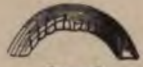
Helix devia (pl. XII., fig. 4) has 23—1—23, with 16 perfect laterals.

Helix profunda (pl. XII., fig. 5) has 40—1—40 teeth, with about 14 perfect laterals.

Helix Sayii (pl. XI., fig. 5) has 42—1—42 teeth, with about 15 perfect laterals.

Subgenus ACANTHINULA.

Fig. 53.

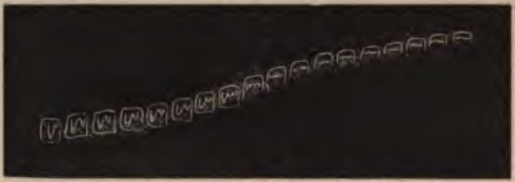


Jaw of *Helix harpa.* [Morse.]

We have but one species within our limits, *H. harpa*, whose jaw and lingual dentition have been described and figured by Morse. Judging from his figure (fig. 53) and text, the anterior surface of the jaw seems to have subobsolete ribs which mark the lower margin; it is low, wide, strongly arched, with blunt, scarcely attenuated ends; cutting edge with a wide and very slightly produced, broad median projection; transversely and longitudinally striate.

Lingual membrane long and narrow, 120 rows of 17—1—17 teeth, with 6 perfect laterals. The centrals have a square base of attachment, the upper margin squarely reflected; the reflection is very small, tricuspid, the side cusps very small, blunt, the median cusps very long and narrow, not reaching the lower edge of the base of attachment, not even with its short cutting point; side cusps also, I presume, with cutting points, though none are shown in Morse's figure. Laterals like the centrals, but unsymmetrical by the suppression of the inner side cusps, and cutting points.

Fig. 54.



Lingual dentition of *Helix harpa*. [Morse.]

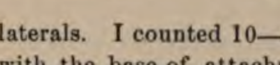
Marginals low, wide, the broad reflection equalling the base of attachment and irregularly denticulated, as in *Pupa*.

There are two European species of this subgenus, *H. aculeata* and *lamellata*, whose jaw is described by Lehmann as rather striated than ribbed. Their lingual dentition presents no subgeneric differences from that of *harpa*, though the cusps of the centrals are described as simply conical.

Subgenus Vallonia.

Jaw low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous crowded, broad ribs, denticulating the lower margin. (Fig. 55.)

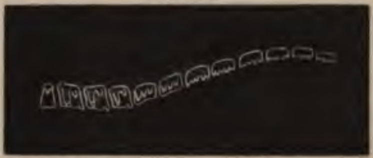
Fig. 55.



Jaw of *Helix pulchella*. [Morse.]

Lingual membrane (pl. XVIII., fig. 6) long and narrow. Morse gives 73 rows of 11—1—11 teeth, with 3 perfect laterals. I counted 10—1—10, with 3 perfect laterals. Centrals with the base of attachment long and narrow, expanded and notched at the outer lower angles, narrowed above and reflected; reflection very small, tricuspid, all the cusps bearing very short cutting points, the central one, as usual, longest. Laterals with the base of attachment twice as broad as in the centrals, the inner lower angle suppressed, notched at the outer angle, broadly reflected above; reflection larger than in the centrals, with one inner, long, slender cusp, reaching nearly the lower edge of the base of attachment, its cutting point quite reaching it, and one small outer side cusp, also bearing a distinct cutting point. Marginals low, wide, the reflection equalling the base of attachment and irregularly denticulated along its edge, the inner cusp the longest and bifid. The dentition is quite that of *Pupa*.

Fig. 56.



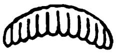
Lingual dentition of *Helix pulchella*. [Morse.]

The above description is drawn from a specimen from Maine. The European form is figured by Moquin-Tandon with a median projection to the cutting edge of its jaw. Lehmann also figures a wide, slight projection to the cutting edge. A comparison of the description and figure of the dentition of the European specimens given by Thomson and Lehmann shows no specific difference. It will be noticed that Lehmann's figure of the centrals shows a more developed reflection and cusp and no side cusps. I believe, however, that careful comparison will show no variation in this or other particulars.

Subgenus Fruticicola.

The two species of this subgenus found within our limits, *H. rufescens* and *H. hispida*, are purely local, having been introduced by commerce at Quebec and Halifax, respectively. I have not had an opportunity of examining either. The jaw of the subgenus is described as arcuate with blunt ends; anterior surface with broad, crowded ribs (see figure of that of *hispida* copied from Moquin-Tandon); Lehmann (l. c., pl. XII., fig. 57) figures the lingual membrane of *hispida* with centrals having a long narrow base of attachment, a stout, pear-shaped, unicuspid reflection; laterals bicuspid, marginals a simple modification of the laterals. Other species are also figured by Lehmann.

Fig. 57.



Jaw of *Helix hispida.*

Subgenus Dorcasia.

I hesitate to place our two species, *H. Berlandieriana* and *griseola* in this subgenus on account of the geographical range of its species. I will, however, temporarily leave them here. I do not believe they properly belong to *Fruticicola.*

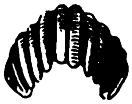
I have not examined *H. Berlandieriana.* The other species, *griseola*, has a jaw (pl. XVI., fig. 14) slightly arcuate; high, ends scarcely *attenuated*, blunt; cutting margin without median projection; anterior surface entirely covered with numerous, about 12, broad, crowded ribs, denticulating either margin.

Lingual membrane (pl. XIII., fig. 2.) long and narrow. Teeth about 27—1—27, with 12 perfect laterals. Centrals with the base of attachment long and rather narrow, the outer lower angles but little expanded, the upper margin broadly reflected; reflection large, with a very stout, long median cusp, bearing a long, stout cutting point extending below the lower edge of the base of attachment, side cusps obsolete, but side cutting points present, large, triangular, acute. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower lateral angle of the base of attachment and inner side cutting point. Marginals (*b*) low, wide, the reflection broad, equalling the base of attachment and bearing one inner, broad, long, oblique, bifid cutting point, the inner division the smaller, and two outer, smaller, stout, sharp, side cutting points.

Subgenus AGLAJA.

Jaw thick, high, arched, ends but little attenuated, blunt; cutting edge without median projection; anterior surface with stout, separated ribs, denticulating either margin, from 5 to 9 in *H. infumata* (fig. 58), about 6 in *fidelis*. The other American species, *H. Hillebrandi*, I have not examined.

Fig. 58.



Jaw of *Helix infumata*.

Lingual membrane long and narrow. That of *Hillebrandi* not examined, those of *infumata* and *fidelis* agreeing in their general characters. The centrals have a base of attachment longer than wide, with incurved lower margin and expanded lower lateral angles; upper margin broadly reflected; reflection short, stout, with no side cusps or cutting points, but a very stout, short median cusp, bearing a short cutting point. Laterals like the centrals, but unsymmetrical by the base of attachment wanting the inner, lower lateral expansion; it is, however, unusually developed on its inner side margin: first marginals (*b* of each figure) differing from the laterals by the equalling of the reflection and base of attachment, the lesser development of the cusp, and greater development of the cutting point, which is bluntly bifid, the inner division the smaller. On some of the first marginals of *infumata* (pl. XIII., fig. 9, *b*) there is a small side cutting point. Marginals low, wide, the reflection equalling the base of attachment, and bearing one long, oblique, wide, bifid cutting point, the inner division the smaller, and one or two short, sharp, side cutting points. There is great variation in the cutting points.

A comparison of the two figures will show a longer base of attachment in *fidelis*, with a line of reënforcement or duplication to its upper margin. As with all species, there is much variation in the length of the cutting point, in centrals and laterals, and their arrangement and development in the marginals.

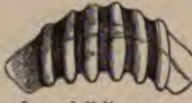
H. fidelis (pl. XIII., fig. 8) has 48—1—48 teeth, with 15 perfect laterals. The first marginal is shown in *b*, an outer marginal in *c*. Usually the first marginals have a side cutting point.

H. infumata (pl. XIII., fig. 9) has 45—1—45 teeth, with 16 laterals. Fig. *b* is the 17th tooth, from a different portion of the membrane from *c*, which is the 20th; they show variation in the transition teeth as to the presence of the side cutting point. Extreme marginals are shown in *d*.

Of the dentition of the other species of *Aglaja* foreign to our limits but little is known. *H. Ghiesbreghti* (see Moll. Mex. et Guat.) has very dissimilar teeth, especially the marginals. *H. semiclausa* (Malak. Blak. XV., pl. IV., fig. 4) also differs in its dentition. The jaws of these species agree with those of *infumata* and *fidelis*.

Subgenus ARIONTA.

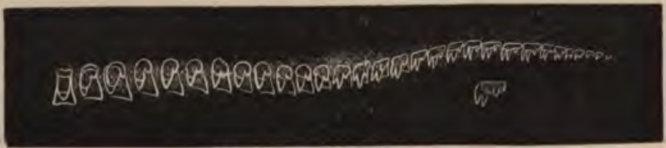
Fig. 59.



Jaw of *Helix arrosa*.

Jaw thick, high, arched, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few, separated, stout ribs, deeply denticulating either margin, and so disposed as to leave each end of the jaw free from ribs. I have counted 6 ribs on the jaw of *arrosa;* 9 in *Townsendiana;* 6 in *tudiculata;* 6 in *Nickliniana;* 6 in *redimita*; 6 in *exarata;* 5 in *Diabloensis;* about 7 in *Carpenteri;* 3 in *ramentosa;* 5 in *Californiensis;* 4–6 in *sequoicola;* 8 in *Traski;* 8 in *facta;* 6 in *Kelletti;* 9 of unequal size in *Stearnsiana*. The jaw of *ruficincta* differs in having over 10 ribs covering its whole surface, and in being only slightly arcuate.

Fig. 60.



Lingual dentition of *Helix facta*.

I have not examined the following species: *intercisa*, *Mormonum*, *Dupetithouarsi*, *Gabbi*.

The subgenus is almost exclusively confined to our limits. There is, however, one *Mexican* species, one African, and one European, *H. arbustorum*. The jaw of the last agrees with our species.

The lingual membrane is long and narrow. Fig. 60 shows the general arrangement of the teeth upon the lingual membrane. The characters of the individual teeth are shown in my plates. I have selected *H. Stearnsiana* pl. XIII., fig. 3, to give an idea of the teeth in successive transverse rows. Fig. *a* shows a group of central and lateral teeth in two adjacent rows, *b* the transition from laterals to marginals, *c* marginal teeth from near the outer edge of the membrane. The central teeth have a base of attachment much longer than wide, with incurved lower margin and expanded lower lateral angles; the upper margin broadly reflected; reflection short, stout, with subobsolete side cusps bearing no cutting points, and a stout, long median cusp bearing a short, blunt cutting point, which does not reach the lower margin of the base of attachment; the reflection with the median cusp is pear-shaped; in many species there is a duplicate line of reënforcement parallel to the upper margin of the base of attachment. The lateral teeth are of similar type to the centrals, but are unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment. The outer laterals have a side cusp and cutting point. The transition from laterals to marginals is formed by the greater proportional development of the cutting point, the lesser development of the cusp; the cutting point then becomes bifid, the reflection becomes more nearly the same size as the base of attachment, and thus the true marginals are gradually reached. These last are longer than wide, have a base of attachment smaller than the reflection and cut away on its lower inner angle; the reflection is produced into one long, sharp, oblique, bifid cutting point, the inner division the smaller, and one outer, much shorter, sharp, rarely bifid cutting point.

Most of the species examined agree in dentition with *Stearnsiana*. Some have more blunt cutting points to their marginals, as *H. sequoicola* (pl. XIV., fig. 5), but even on various parts of the same membrane the marginals vary in this respect. In *Kelletti*, *Stearnsiana*, *tudiculata*, *arrosa*, *Traski*, *sequoicola*, *Ayresiana*, *redimita*, *Nickliniana*, *ramentosa*, *exarata*, I have failed to detect any side cutting points to the central and inner lateral teeth. I found the points, however, in *H. ruficincta* (pl. XIV., fig. 3). *H. Townsendiana* (pl. XVIII., fig. 8) has these cutting points and side cusps on central and all the lateral teeth; its centrals and laterals are not of the same shape as described above for *H. Kelletti*, but resemble those of *Polygyra*, *Stenotrema*, and *Triodopsis*. Thus in this as in other subgenera, we find the type of dentition not constant in all the species.

The long, narrow base of attachment and pyriform reflection of most of the species of *Arionta* agree with those of *Hemitrochus* (see p. 181) more nearly than any other of our genera or subgenera, but that genus has quite different marginal teeth.

The dentition of *H. arbustorum* is alone known of the species foreign to America, and that by a figure of Lehmann (Lebenden Schnecken, pl. XI., fig. 29) too unsatisfatory to be of value for the purpose of comparison.

H. arrosa (pl. XIV., fig. 2), 54—1—54 teeth. 17 laterals.

H. Townsendiana (pl. XVIII., fig. 8) has 60—1—60. Another membrane had 40—1—40.

H. tudiculata (pl. XIV., fig. 1), 50—1—50, with 26 perfect laterals.

H. Nickliniana (pl. XIV., fig. 8).

H. Ayresiana (pl. XIV., fig. 6), 50—1—50, with 15 perfect laterals.

H. redimita (pl. XIV., fig. 7). The 17th tooth has its inner cutting point split. 43—1—43.

H. intercisa, not examined.

H. exarata (pl. XIV., fig. 10), 54—1—54, 19 perfect laterals.

H. ramentosa (pl. XIV., fig. 9), 60—1—60, with 21 perfect laterals. The 18th tooth has the side cutting point.

H. Californiensis (see L. and Frw. Sh., I., p. 171, fig. 297). Teeth 56—1—56.

H. Carpenteri. Too late for illustration, I have received specimens collected by Mr. Henry Hemphill. There are 48—1—48 teeth, with 20 laterals; the side cutting points are visible beyond the 7th tooth.

H. Mormonum, not examined.

H. sequoicola (pl. XIV., fig. 5), 46—1—46, 18 perfect laterals.

H. Diabloensis.

Too late for illustration, I have received from Mr. L. G. Yates specimens of the form called *Diabloensis* by Dr. Cooper. There are 37—1—37 teeth, with 17 laterals. There are side cutting points beyond the 12th tooth.

H. Traski (pl. XIV., fig. 4), 36—1—36; the 13th tooth has the side cutting point; 16 laterals.

H. Dupetithouarsi, not examined.

H. ruficincta (pl. XIV., fig. 3), 35—1—35, with 18 laterals.

H. Gabbi, not examined.

H. facta (see p. 216, fig. 60), 29—1—29, with 11 laterals.

H. Kelletti (pl. XIII., fig. 4), 57—1—57.

H. Stearnsiana (pl. XIII., fig. 3), 50—1—50, with 24 laterals. The 22d tooth has the side cutting point.

Subgenus GLYPTOSTOMA.[1]

One species only is thus far known, *Helix Newberryana*. Its jaw (pl. XVI., fig. 4) is low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous (about 16), stout, separated ribs, deeply denticulating either margin.

Lingual membrane (pl. XIII., fig. 6) long and narrow. Teeth 47—1—47, with 17 perfect laterals. Centrals with the base of attachment long and narrow, with greatly expanded lower, lateral angles, the upper margin rounded, broadly reflected; reflection large, stout, with obsolete side cusps, but with decided, triangular side cutting points; median cusp very stout, short, with a long, acute cutting point reaching beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of inner, lower, lateral angle of the base of attachment and inner side cutting point. The transition from laterals to marginals is marked by the lesser proportional development of the cusp and greater development of the cutting point. Marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique, blunt cutting point, and one outer, shorter, blunt cutting point.

This species, like all others, has great variation in the development of the cutting points on different parts of the same membrane.

Subgenus EUPARYPHA.

Jaw high, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few (about 5 in *Tryoni*) stout, separated, unequal ribs, deeply denticulating either margin.

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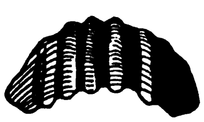
[1] See Proc. Phila. Ac. Nat. Sci., 1873, p. 244.

Fig. 61.



Jaw of H Tryoni.

As usual in most of the species of *Helix*, etc., examined by me, the number, size, and disposition of the ribs vary in different individuals of the only species of *Euparypha* I have examined, *H. Tryoni*. In L. and Frw. Shells N. A., I., 179, six jaws are figured, all differing as to the ribs.

I have had no opportunity of examining *H. areolata*, the only other species found within our limits. Among the species of the subgenus foreign to the United States, *H. pisana*, Müll., alone has been examined, the jaw being figured by Moquin-Tandon with 2–3 ribs only, and the number of the teeth being given by Thomson.

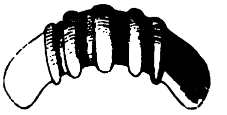
The only information I can give of the lingual dentition is shown in the figure of that of *H. Tryoni* (L. and Frw. Shells, I., 354). There are 190 rows of about 43—1—43 teeth each. There appear to be 16 perfect laterals.

The base of attachment is long and narrow; the reflection is pear-shaped, apparently without side cusps or cutting points in the central and first nine laterals. The balance of the laterals have the side cusp, and, no doubt, cutting point. I cannot from the figure describe accurately the characteristics of the marginal teeth. Unfortunately, I have preserved no membrane to describe and figure more accurately.

Subgenus Tachea.

Our single species, *H. hortensis*, found only along the northeastern coast, and there usually restricted to the islands, agrees in its jaw with the other known species of the subgenus. It is stout, arched, with blunt unattenuated ends; anterior surface with stout, few, separated ribs, denticulating either margin.

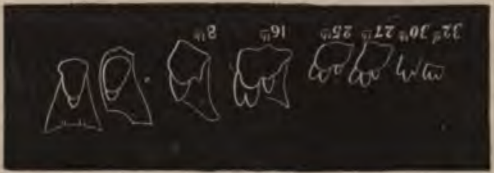
Fig. 62.



Jaw of Helix hortensis. [Morse.]

The lingual membrane has 116 rows of 32—1—32 teeth each. The centrals have a subtriangular base of attachment, so greatly are the lower lateral angles expanded; upper margin reflected; reflection pear-shaped, without outer cusps, but a single stout middle cusp, half as long as the base of attachment, and bearing a short, conical cutting point, reaching only about one-half the distance to the lower edge of the base of attachment. First laterals like the centrals, but unsymmetrical by the irregular cutting away of the lower inner angle of the base of attachment; outer laterals with a more developed cutting point and a decided side cusp and cutting point; the change from the laterals to the marginals is shown in the 16th tooth (see fig. 63), where the base of attachment is wider, the reflection stouter and the inner cutting point becomes bifid. The marginals are low, wide, the reflection equalling the base of attachment, the inner cutting point short, bluntly bifid, the outer shorter and blunt.

Fig. 63.



Lingual dentition of *Helix hortensis*. [Morse.]

Having no specimen to examine myself, I am dependent on Morse's figures given above.

Subgenus Pomatia.

Jaw of our only species, *H. aspersa*, introduced by commerce at Charleston, S. C. (where it is still common), high, thick, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with 6 stout, separated ribs, deeply denticulating either margin (pl. XVI., fig. 8).

Lingual membrane of the same species (pl. XIII., fig. 7, *a*, *b*, *c*) long and narrow. Teeth 50—1—50, with 15 perfect laterals. Centrals with base of attachment longer than wide, the lower lateral angles but slightly produced, the lower margin in some cases with a quadrate excavation or thinning as usually found in *Succinea;* the upper margin broadly reflected, reflection very large, with a very stout, short median cusp, bearing a short, stout cutting point reaching the lower edge of the base of attachment; side cusps obsolete, but bearing well developed, short side cutting points. Laterals like centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. Transition teeth from the laterals to the marginals (*b*) with a more developed reflection, a shorter inner cusp bearing a greatly developed bifid cutting point. Marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, long, oblique, acutely bifid cutting point, and one shorter, outer, sometimes bifid, side cutting point.

The only other *Pomatia* whose dentition has been figured is *H. pomatia*, which shows the same type of teeth (Goldfuss, l. c. pl. IV., fig. 6). The jaw of numerous European species is known, and of the same type as in *aspersa*.

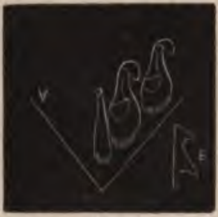
(3) Jaw with delicate, distant ribs to its anterior surface, usually running obliquely to the median line.

Genus **CYLINDRELLA**, Pfr.

Jaw as in *Macroceramus*, described below.

Lingual membrane of our two species *C. jejuna* and *C. Poeyana* not examined by me. The dentition of the genus is very peculiar. The membrane is exceedingly long and narrow. The base of attachment of the centrals is small, long, narrow, with the upper margin broadly reflected into a blunt, rounded and expanded gouge-shaped cutting point; the laterals have a long, subquadrangular base of attachment, bearing below, a large, bluntly rounded, greatly expanded, palmate cusp, representing the inner and central cusps of the laterals; and, above, a long, slender, graceful extension, representing the external cusp of the other *Helicidæ*. This last is bluntly truncated, or bears a recurved cusp smaller but of same shape as that below; or it has a laterally extended, small blunt point. In some species the laterals extend to the margin of the lingual membrane;[1] in others there are distinct marginal teeth, long, narrow, laminar, with bluntly recurved apices. A full description and figures of these various forms of teeth will be found in Journal de Conchyliologie, January, 1870.

Fig. 64.



Lingual dentition of *Cylindrella scæva*. [Bland.]

I here give a figure of the dentition of one only of these types represented by the membrane of *C. scæva*.

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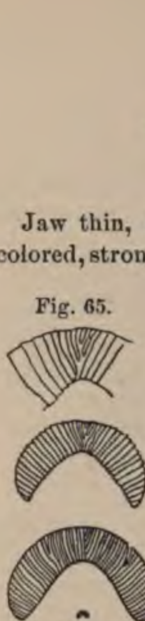
[1] Probably this is the case in our species, as it is so in the allied *C. elegans*. See pl. XX., fig. 6.

Since the above was written, I find my anticipations realized in the case of *C. Poeyana*. Specimens from Key West collected by Mr. W. W. Calkins, have 14—1—14 teeth of same type as in *elegans*. There are over 40 ribs on the jaw.

Genus **MACROCERAMUS**, Guild.

Fig. 65.



Jaw of *Macroceramus signatus.* [Bland.]

Jaw thin, almost membranous, semi-transparent, light horn colored, strongly arched, ends acuminated; cutting margin without median projection; anterior surface with numerous delicate, separated ribs, denticulating both margins; these ribs run obliquely towards the median line of the jaw, so that the central ribs meet before reaching the lower margin of the jaw, forming an upper median triangular space between the ribs.

It was formerly considered that this jaw was actually in separate pieces, whose overlapping margin formed the ribs upon the anterior surface (see fig. 65). More careful examination, however, has proved the jaw to be in one single piece, with delicate ribs upon its surface.

There are over 50 ribs on the jaw of the only one of our species I have examined, *M. Gossei*. I give a copy of Mr. Bland's figure of the jaw of *M. signatus*, which is similar.

The lingual membrane of *Macroceramus* was supposed to be the same as in *Cylindrella* described above, as that of *M. signatus* was so found by Mr. Bland (Ann. Lyc. Nat. Hist. N. Y., VIII., 162), and Crosse and Fischer (Journ. de Conch., 1870, pl. III., fig. 14–16). It was, therefore, with surprise that I found an entirely different type of dentition in *M. Gossei*. I can in this place only note the difference, and leave to future study the question of its bearing on the generic position of the species.

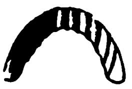
M. Gossei (pl. XV., fig. 1) has a membrane very long and narrow; teeth about 40—1—40, in scarcely oblique transverse rows, decidedly not *en chevron*. Centrals with a long, narrow base of attachment with somewhat expanded lower lateral angles, its upper margin squarely reflected. The reflected portion is very small, and bears three short, blunt cusps, the median the largest, all three with distinct cutting points. The base of attachment of the laterals is long and narrow, its outer lower angle irregularly cut away; the upper margin broadly and obliquely reflected, the reflected portion thrown off obliquely towards the margin of the lingual membrane, very short and bearing two stout, blunt, short cusps, the inner the larger, also thrown obliquely towards the outer margin of the membrane; both of the cusps bear distinct cutting points, the outer one small, the inner one narrow, blunt, almost as long as the base of attachment. There are no distinct marginals, the laterals decreasing in size as they pass off laterally, those at the edge of the membrane (fig. *c*) having one large inner cutting point, and several, outer, irregular smaller ones. I have given *a* a group of centrals and laterals, *b* a group of laterals, and *c* an extreme lateral or marginal.[1]

I have had no opportunity of examining *M. Kieneri.*

Genus **BULIMULUS**, Leach.[2]

Jaw thin, arcuate, ends but little attenuated; no median projection to the cutting edge; anterior surface with numerous, separated, delicate ribs, denticulating either margin, sometimes the upper median ones running obliquely towards the median line, or even arranged *en chevron* as in *Macroceramus*, with an upper median triangular compartment.

Fig. 66.



Jaw of *Bulimulus dealbatus.*

The jaw of *B. dealbatus* is here figured. It is quite arched. That of *B. Marielinus* and *alternatus* is of the same type. I have given on plate XVI., fig. 12, a more enlarged view of one end of the jaw of *B. sufflatus*, to show more accurately the character of the ribs.

The lingual membrane of the genus as now received varies too much to allow of a general description. It can only be said that the marginal teeth are quadrate, not aculeate. I will here simply confine myself to describing the membrane of the only one of our species of which I have preserved the lingual membrane.

Fig. 67 shows the general arrangement of the teeth on the membrane of *B. dealbatus*, the characters of the individual teeth being shown in pl. XV., fig. 7. There are 94 rows of 25—1—25 in one specimen examined. Another had 20—1—20 teeth, with 14 perfect laterals.

The central tooth has a base of attachment longer than wide, with but little expanded lower lateral angles, its lower margin incurved, its upper margin broadly reflected. The reflection is large and has subobsolete side cusps bearing well developed cutting points, and a short, stout median cusp, bearing a short, stout cutting point not quite reaching the lower margin of the base of attachment. The laterals are of the same general form as the centrals, but are larger, broader in proportion, and are rendered unsymmetrical by the suppression of the lower inner angle of the base of attachment, and inner side cusp and cutting point. The marginal teeth (fig. *b*) are but a simple modification of the laterals, formed by the proportionally greater development of the reflection in comparison with that of the base of attachment, and the greater development of the cutting points. On the extreme marginals the cutting points are shorter and much blunter (fig. *c*).

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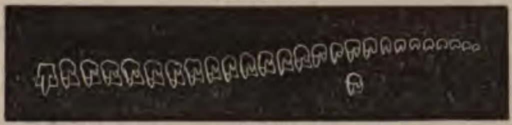
[1] Similar dentition is found in *M. turricula*, Pfr., of Cuba. See below, pl. XX., fig. 9.

[2] I use this generic name only temporarily. As suggested by von Martens, it must eventually be restricted to those species whose dentition is like that of *B. Guadelupensis*, the type of the genus.

Fig. 67.



Lingual dentition of *Bulimulus dealbatus.*

The dentition of *Bulimulus alternatus* is figured on p. 203 of L. and Frw. Shells, I. I have preserved no specimen from which I can more accurately draw the individual teeth. It has 75 rows of 37—1—37 teeth, all apparently of the same character as in *B. dealbatus.*

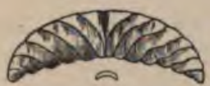
I have not examined *B. multilineatus*, *Dormani*, *Marielinus*, *Floridanus*, *patriarcha*, *Schiedeanus.*

c. Jaw in numerous distinct pieces, sometimes soldered together above, free and imbricated below. Marginal teeth quadrate. ORTHALICINÆ.

Genus **LIGUUS**, Montf.

Jaw thick, arcuate, ends rapidly attenuated, pointed; composite, being in numerous, separate, free, imbricated, triangular pieces, with sutures inclined obliquely to the centre of the jaw, so as to leave an upper median, angular piece; other pieces are soldered together above. Cutting edge with no median projection, serrated by the lower angles of the oblique pieces. For more detailed description see below, under *Orthalicus*, which has a similar jaw. I am

Fig. 68.



Jaw of *L. virgineus.*

not able to give a figure of the jaw of the only species found within our limits, *L. fasciatus*. It is however figured by Leidy (Terr. Moll. U. S., I., pl. V., fig. 4, *a*, *b*). It is similar to that of the allied species *L. virgineus*, which is here figured on p. 225.

The only species found within our limits, *L. fasciatus*, has about 69—1—69 teeth, judging from a membrane examined by me. That figured in L. and Frw. Shells, I., p. 214, has 94 rows of 55—1—55 teeth each. As elsewhere stated, there is often a difference in the number of transverse teeth in almost all species, and indeed upon different parts of the same membrane.

The central tooth (pl. VI., fig. E, *a*) has a base of attachment long and narrow, with strongly incurved sides, widely expanded, excurved and fringed lower margin, and upper margin less expanded, rounded, and broadly reflected. The reflection is stout and very rapidly narrows without any appearance of side cusps into a very broad, long, bluntly rounded median cusp, bearing a still broader, short, bluntly truncated cutting edge (as such a blunt organ cannot be called a point) reaching nearly to the lower edge of the base of attachment. It may be that I have here incorrectly considered the upper margin of the base of attachment as reflected and extended into the cusp. As in the case of the side teeth, I should, perhaps, rather say that the upper margin is not reflected, but that just below the middle of the base of attachment there springs up from its surface a broad, gouge-shaped cusp, bearing a still broader cutting edge (see pl. VI., fig. E, *d*, where the form of the cusp of the side teeth is shown by the profile). The side teeth run rapidly and obliquely backward from the central tooth, thus giving a chevron-like arrangement to the membrane. The teeth are crowded together both longitudinally and transversely, excepting as they approach the outer edges of the membrane, where they are much more separated.

I have used the term side teeth instead of lateral and marginal teeth, because it is difficult to decide which of these types they properly are. Taking into consideration the fact of there being distinct lateral teeth in the allied species, *L. virgineus*, and that the marginals of that species resemble the side teeth of *L. fasciatus*, I am inclined to believe we should consider all the side teeth of *fasciatus* as marginals. In this case we must consider that the lateral teeth are entirely suppressed. The marginals, as I have decided to call them, are of the same type as the centrals.

The base of attachment is, however, unsymmetrical by the suppression of both upper and lower inner lateral expansion; the upper margin is simply squarely truncated. Above the centre of the base of attachment springs from its surface the gouge-shaped, rounded, gradually expanding cusp reaching nearly the lower margin of the base of attachment and produced into a still more expanded, bluntly truncated cutting edge (one cannot call it a cutting point), which projects far beyond the lower margin of the base of attachment on to the teeth of the next transverse row, and is also greatly expanded on the outer side, so as to overlap the adjoining tooth. This cutting edge is slightly incurved at its centre. There is one point of difference between the central and adjoining marginal teeth which is very marked; in the centrals the lower margin of the base of attachment is more expanded than the cutting edge, the reverse of which is found in the marginals.

The marginals retain this general form to the extreme edge of the membrane, but they decrease greatly in size upon the edge. The outer marginals have to their cusps a small side spur, gouge-shaped as the cusp itself; the extreme marginals have such a spur at either side. In both cases the cutting edge springs from the outer side of this side spur, which must be considered as representing the side cusps of the usual *Helicinæ* type of dentition. I have elsewhere (Ann. Lyc. N. H. of N. Y., XI., 39) shown that this type of tooth is but a modification of the usual type brought about by the expansion, bluntly rounding and shortening of the cusps, and the still greater expansion, bluntly rounding and shortening of the cutting points, which are quite changed into wide cutting edges.

I have given on pl. VI., fig. E, a group of central and marginal teeth in *a*, an outer marginal in *c*, a marginal in profile in *d*.

The allied species *L. virgineus* differs from *fasciatus* in having a long blunt cutting point to its central tooth, and by the presence of several true lateral teeth with long cutting points, also in the presence of several teeth showing a gradual change from the laterals to the marginals. A full description and detailed figures of its dentition are given by me in Ann. Lyc. Nat. Hist. N. Y., XI., 41, pl. III.

Liguus is nearly allied in its lingual dentition to *Orthalicus*, but in that genus also I have found one species with true lateral teeth, as will be shown below.

Genus ORTHALICUS, Beck.

Jaw composite, in numerous free, imbricated pieces, usually with its sutures oblique to the centre of the jaw, leaving an upper, angular, median piece; these pieces soldered together above. No median projection to the cutting edge, which is serrated by the lower angles of the separate pieces.

The jaw of the only species within our limits, *O. undatus*, Brug. (pl. XVI., fig. 13) is of the type usual in this genus and *Liguus*, but up to the present time never observed in any other genus. It is composite, its separate pieces being apparently soldered firmly at their upper portions, where, indeed, they seem collectively to form a jaw in a single piece as in *Helix*, etc., but at their lower portion positively detached and free, imbricated one upon another. The jaw may in one sense be said to be in a single piece, as argued recently by Messrs. Fischer and Crosse (Moll. Mex. et Guat.), but with equal correctness it may surely be said to be composite, as the amalgamation of the upper portion is produced by the joining of absolutely separate pieces. There are seventeen of these plates in the jaw figured, though the number varies, the upper central one apparently lying upon the adjoining ones, which are broad and extend from the upper to the lower margin of the jaw. The jaw is strongly arched, with attenuated, blunt ends. There are well-marked perpendicular grooves upon the anterior surface of many of the plates The upper central plate is triangular, from which fact the name *Goniognatha* has been applied to the section I have called *Orthalicinæ*. *Cylindrella*, *Macroceramus*, *Pineria*, *Partula*, and some species of *Bulimulus* also have an upper median triangular compartment to their jaw, but in their case the jaw is in one single piece, with distant, delicate ribs, running obliquely to the central line, some of the upper ones meeting before reaching the lower margin of the jaw, thus leaving a triangular space, not a separate piece.

I have myself figured the jaw of *O. melanochilus*, Val., under the name of *O. zebra* (L. and Frw. Shells N. A., I., p. 215, fig. 367), of *gallina-sultana* (Ann. N. Y. Lyc. Nat. Hist., XI., pl. IV., fig. E). The last named has also been figured by Troschel (Arch. für Nat., 1849, pl. IV., fig. 3); the jaw of *O. iostomus* is figured by Crosse and Fischer (Moll. Mex. et Guat., pl. XIX., fig. 8), and *O. longus* by the same authors (l., c. pl. XIX., fig. 1). I have also examined the jaw of *O. obductus*, Shuttl. (Ann. Lyc. N. H. of N. Y., XI., p. 37.) All these species have the same composite type of jaw.

The lingual dentition of *Orthalicus undatus* is so nearly similar to that of *Liguus fasciatus*, that I merely compare it with the description given above of that species. In *O. undatus* the central tooth (pl. VI., fig. D) is broader in proportion to its length; the base of attachment is less expanded at the upper margin, and very much less so at its lower margin, and the sides are not incurved; the cusp is stouter, longer, reaching the lower edge of the base of attachment, and it has subobsolete, but distinctly marked side cusps; the cutting edge is much more expanded, overlapping the next row of teeth. The first marginals differ from those of *L. fasciatus* in having a less developed cutting edge, the outer marginals have the side spurs to their cusps much more developed and even the cutting edge is trilobed. The extreme marginals are not so small. There are about 53—1—53 teeth, on one part of one membrane; a wide part of another membrane had 106—1—106.

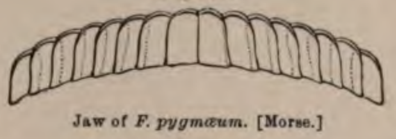
All the species of *Orthalicus* enumerated above whose dentition is known have the same type of teeth as *O. undatus*, excepting *O. gallina-sultana*. This last (see Ann. Lyc. N. H. of N. Y., XI., 38, pl. IV., fig. A) is peculiar in having a long, stout cutting point with subobsolete side points to its central tooth, and three lateral teeth of same form but unsymmetrical. Thus in both *Liguus* and *Orthalicus* we find the usual type of dentition is not constant excepting as to the marginal teeth.

O. zebra. Too late for illustration I have received specimens from Key West, collected by Mr. W. W. Calkins. It is the form figured in Terr. Moll. U. S., IV., pl. LXXVIII., fig. 12, and copied in L. and Frw. Shells N. A., I., p. 216, fig. 370 (not fig. 371, which is referred by Fischer and Crosse to *O. melanochilus*, Val.). The jaw has 7—1—7 separate pieces. The lingual membrane has 126—1—126 teeth. The teeth are of same type as in *O. undatus*, but the cutting edge of the centrals and first laterals is shorter than the base of attachment. It is, perhaps, a variety of *undatus*.

Genus **PUNCTUM**, Morse.

But one species of this genus has been described, *P. pygmæum*, Dr., hitherto known in America as *Helix minutissima*, Lea. A full account of its history with all published information relating to it has been given by Mr. Bland and myself in Ann. of Lyc. Nat. Hist. of N. Y., X., 306. The jaw is low, wide, slightly arcuate, with blunt, squarely truncated ends; it is composed of sixteen separate pieces, each higher than wide, with slightly overlapping edges; these pieces do not run obliquely towards the middle of the jaw, there is, therefore, no appearance of an upper median triangular piece as in *Orthalicus* and *Liguus*.

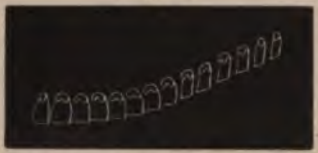
Fig. 69.



Jaw of *F. pygmæum*. [Morse.]

The lingual membrane is long and narrow. There are 54 rows of 13—1—13 teeth each. The centrals have a base of attachment much longer than wide, expanded below and squarely truncated, very much narrowed above, reflected. The reflection is very small and has, according to Morse, one single cusp, but Schacko (Malak. Blatt. 1872, 178) describes the reflection in some European specimens as tricuspid. Laterals of same form as centrals, but with wider base of attachment in the first ones and bicuspid; outer laterals much narrower. There are no distinct marginals. All the teeth are decidedly separated.

Fig. 70.



Lingual dentition of *P. pygmæum*. [Morse.]

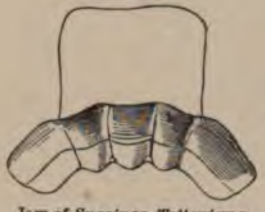
I have not examined the jaw or lingual membrane of this species, but am entirely dependent on Morse for the descriptions and figures of the American form given above. While treating of the identity of the American and European forms in the paper referred to above, we have pointed out the differences in the jaw and membrane of the two forms, which, however, do not appear to be of specific value.

d. Jaw in a single piece, with an accessory, quadrate plate above. Marginal teeth quadrate. SUCCININÆ.

Genus **SUCCINEA**, Drap.

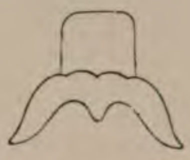
Jaw with an upper, quadrangular, accessory plate. The jaw is strongly arched, the ends acuminated in *S. avara* (fig. 71), blunt in *obliqua*, *ovalis*, *Totteniana* (fig. 71), *campestris*, *lineata*, and *effusa;* there is a median projection to the cutting margin, sometimes broken by the ends of ribs. These ribs are found in *S. Totteniana* (3) (see fig. 71); *S. obliqua* (3–7); *ovalis* (over 7); I detected no ribs on that of *S. avara*, *lineata*, *campestris*, *Nuttalliana*, *Sillimani*, *or effusa*.

Fig. 71.



Jaw of *Succinea Totteniana*. [Morse.]

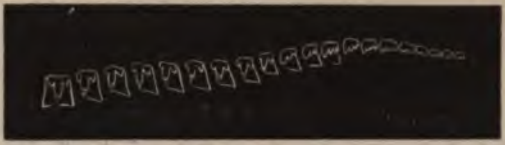
Fig. 72.



Jaw of *Succinea avara*.

The general arrangement of the lingual membrane is shown in fig. 73 of *S. avara*, while the characters of the separate teeth are better seen in pl. XV., fig. 3. The peculiar character of the dentition is the cutting away or thinning of the middle portion of the lower edge of the base of attachment in the central teeth, and the inner lower lateral angle of the base of attachment in the laterals and still more in the marginals. The marginal teeth are also often peculiar in the denticulation of their reflected cusps. They have usually two small outer side cusps, the inner the smaller, each bearing cutting points proportioned to their size. The reflection of the teeth is also small in proportion to the base of attachment. In other respects the dentition of the genus is very much like that of the *Helicinæ*.

Fig. 73.



Lingual dentition of *Succinea avara*.

Succinea Sillimani (pl. XVII., fig. 12) has 24—1—24 teeth.

Succinea ovalis has not been examined by me. Morse gives 80 rows of 40—1—40 teeth.

Succinea lineata (pl. XV., fig. 11) has 26—1—26 teeth, with 4 perfect laterals, but the transition to marginals is very gradual. The teeth have a very broad base of attachment, and very slender, sharp cutting points.

Succinea avara (pl. XV., fig. 3) has 21—1—21 teeth, with about 8 perfect laterals. Morse counted 19—1—19 teeth.

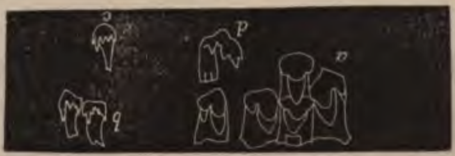
Succinea obliqua (pl. XV., fig. 4) has 43—1—43 teeth, with 10 perfect laterals.

Succinea Totteniana is said by Morse, whose figure is given in L. and Frw. Shells, I., p. 267, to have 100 rows of 33—1—33 teeth. The bases of attachment are very narrow.

Succinea campestris (pl. XV., fig. 10) has 18—1—18 teeth, with about 10 perfect laterals. Morse gives 50 rows of 30—1—30. The central tooth has a peculiarly narrow base of attachment, and a very greatly developed median cusp, the side cusps being subobsolete.

Succinea Nuttalliana (fig. 74). Teeth 19—1—19.

Fig. 74.



Succinea effusa (pl. XV., fig. 6) has 15—1—15 teeth, with 10 perfect laterals.

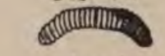
Succinea Stretchiana (pl. XX., fig. 7). 16—1—16. 8 laterals.

I have had no opportunity of examining the other species of *Succinea* found within our limits.

Family VERONICELLIDÆ.

Genus **VERONICELLA** Blainv.

Fig. 75.



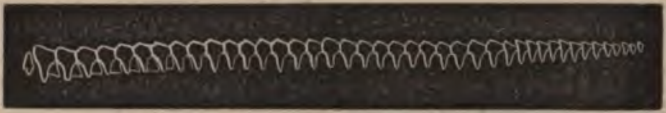
Jaw of *Veronicella Floridana.*

Jaw (fig. 75) low, wide, thick, slightly arcuate; ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous, stout, crowded ribs, denticulating either margin, 24 in *V. Floridana*.

Lingual membrane, as seen in fig. 76, is arranged as usual in the *Helicinæ*, the transverse rows being almost horizontal. By fig. 11 of pl. XVII., representing *V. Floridana*, it will be seen that the teeth are of a very peculiar type.

The lingual membrane is long and very broad, comprising (in the Florida species) about 60—1—60 teeth. The centrals have their base of attachment quite small, long and narrow, attenuated to a point above, gradually enlarging toward the base, above which are lateral, bluntly pointed, wing-like expansions; the lower margin is broad, and has a deep, rounded excavation; in some cases the lateral expansions are so produced as to give an almost cruciform appearance to the base of attachment; below the centre of the base of attachment, on its anterior surface, is a stout, blunt, short, simple cusp, ending in a short, stout cutting point.

Fig. 76.



Lingual dentition of *Veronicella Floridana*.

The lateral teeth are very irregular in shape, but retain the bicuspid character peculiar to the *Geophila;* they are longer and much wider than the centrals; the bases of attachment are very irregular in shape, very unsymmetrical, subquadrate or irregularly excavated above, thence curve outwards and downwards, until at their lower extremity they exhibit the lateral expansions and basal excavation of the central tooth, but both these characters are much more developed than in the centrals, and from the want of symmetry in the teeth, are found only on the outer side of each tooth; the upper edge is squarely reflected, the reflection is very large, extends half way to the lower edge of the base of attachment, and is produced beyond that into a blunt, stout cusp bearing a stout cutting point; the side cusps are almost obsolete, the inner one is much larger than the outer one, neither with distinct cutting point. The marginal teeth are a simple modification of the laterals, being reduced to a subquadrate shape, with the cutting point of the cusp much more produced.

I give on pl. XVI., fig. 11, a group of centrals and laterals in *a*, a marginal in *b*.

I have not been able to examine *V. olivacea*, the only other species found within our limits.

The species of the genus foreign to the United States hitherto examined agree in their jaw and lingual dentition with *V. Floridana.*

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. Glandina truncata, Say.
  a. Central and adjacent marginals.
  b. The twentieth tooth.
  c. The last tooth.
Fig. 2. Macrocyclis Duranti, Newc.
  a. Central and adjacent teeth.
  b. The last two teeth.
Fig. 3. M. concava, Say.
  a. Central and adjacent teeth.
  b. The last ten teeth.
  c. The last tooth from another part of the membrane.
Fig. 4. M. Vancouverensis, Lea.
  a. Central and adjacent teeth.
  b. The last five teeth.
  c. The first lateral seen from above on a different scale of enlargement.
Fig. 5. M. Voyana, Newc.
  a. Central and adjacent teeth.
  b. Extreme marginals.

NOTE.—This plate must be studied in connection with the descriptions in the text. It will there be seen that Fig. 2*a* and Fig. 4*a* are taken from below, to better show the base of attachment. Figs. 3*a*, 5*a*, and 4*c* are taken from above, and more correctly show the form of the cusp.

PLATE II.

Fig. 1. Zonites lævigatus, Pfr. The central tooth with all the teeth to the right of it.
Fig. 2. The same, more highly enlarged, to the fifth tooth.
Fig. 3. Zonites cellarius, Müll. Same reference as in fig. 1.
Fig. 4. Zonites friabilis, W. G. B.
  a. Central and adjacent lateral.
  b. Extreme marginals from two adjacent rows.
Fig. 5. Zonites inornatus, Say.
  a. Central and first three laterals.
  b. Marginal tooth fourth from the end.

Fig. 6. Zonites capnodes, W. G. B.
- *a.* Central and first lateral.
- *b.* Marginal teeth.

Fig. 7. Zonites fuliginosus, Griff.
- *a.* Central and first lateral.
- *b.* Third marginal from edge of lingual membrane.

PLATE III.

Fig. 1. Zonites gularis, Say.
- *a.* Central and first lateral tooth.
- *b.* Marginal tooth.

Fig. 2. Zonites sculptilis, Bland.
- *b.* Extreme marginals.

Fig. 3. Zonites limatulus, Ward.

Fig. 4. Zonites capsella, Gould.

Fig. 5. Zonites Elliotti, Redf.
- *b.* An extreme marginal.

Fig. 6. Zonites demissus, Binn.

Fig. 7. Zonites lasmodon, Phillips.
- *c.* Last marginal but three.

Fig. 8. Zonites intertextus, Binn.

Fig. 9. Zonites internus, Say.
- *b.* The 16th and 17th tooth.
- *c.* The 25th tooth.

Fig. 10. Zonites Gundlachi, Pfr.
- *b.* A group of marginals.

Fig. 11. Zonites ligerus, Say.

Fig. 12. Zonites capnodes, W. G. B.
- *a*, *b*, *c*, *d.* The base of attachment.
- *e.* The reflection.
- *f*, *f.* The obsolete side cusps.
- *g*, *g.* The side cutting points.
- *h.* The central cusp.
- *i.* Central cutting point.

PLATE IV.

Fig. 1. Limax flavus, Lin.
- *a.* Central and first lateral teeth.
- *b.* Marginal tooth before the bifurcation commences.
- *c.* An extreme marginal, to show the bifurcation of the marginals.

Fig. 2. Limax Hewstoni, J. G. Coop.
  a. Central and first lateral teeth.
  b. Extreme marginals.
Fig. 3. Limax agrestis, Lin.
  a. Central and first lateral teeth.
  b. First marginal teeth.
  c. Last three marginals.
Fig. 4. Limax maximus, Lin.
  a. A group of central and adjacent laterals.
  b. A marginal tooth before the commencement of the bifurcation.
  c. An extreme marginal, showing the bifurcation.
Fig. 5. Limax campestris, Binney. Same references as in fig. 1.
Fig. 6. Vitrina Pfeifferi, Newc.
  a. Central and lateral teeth.
  b. Extreme marginal.
Fig. 7. Vitrina exilis, Mor.
  a. Central and lateral teeth.
  b. First marginals.
  c. Last marginals.
Fig. 8. Vitrina limpida, Gould. Same references as in fig. 6.

PLATE V.

Fig. 1. Ariolimax Californicus, J. G. Cooper.
  a. Central and first lateral teeth.
  b. Marginal teeth.
Fig. 2. Ariolimax niger, J. G. Cooper. Extreme marginal teeth of an exceptional form.
Fig. 3. Ariolimax niger, J. G. Cooper. Same references as in fig. 1.
Fig. 4. Prophysaon Hemphilli, Bl. and Binn. Same references as in fig. 1.
Fig. 5. Arion hortensis, Fér. Same references as in fig. 1.
  c. Extreme marginal.
Fig. 6. Ariolimax Columbianus, Gld.
  a. Central and first lateral teeth.
  b. c. Transition teeth from laterals to marginals.
  d. Marginal tooth.
  e. Extreme marginal tooth.
  f. Marginal tooth in profile.

Fig. 7. Hemphillia glandulosa, Bl. and Binn.
- *a*. Central and first lateral teeth.
- *b*. Transition from lateral to marginal teeth.
- *c*. Marginal teeth near the edge of the membrane.
- *d*. Extreme marginal tooth.

PLATE VI.

Fig. A. Tebennophorus Caroliniensis, Bosc.
- *a*. The central tooth.
- *b*. The first lateral.
- *c*. The last laterals.
- *d*. Marginal teeth.
- *e*. Extreme marginals.

Fig. B. Pallifera Wetherbyi.
- *a*. Central and lateral tooth.
- *b*. Extreme marginals.

Fig. C. Pallifera dorsalis, Binn.
- *a*. Central and two lateral teeth.
- *b*. Marginal tooth.
- *c*. Extreme marginal.

Fig. D. Orthalicus undatus, Brug. The central and first, second, fifteenth, forty-eighth, and fiftieth marginals.

Fig. E. Liguus fasciatus, Müll.
- *a*. A group of central and marginal teeth.
- *b*. Marginal far removed.
- *c*. An extreme marginal.
- *d*. A marginal in profile.

PLATE VII.

Fig. 1. Patula strigosa, Gld.
- *a*. Central and lateral teeth.
- *b*. Marginal teeth.
- *c*. Outer marginal tooth.
- *d*. An outer lateral on a different scale of enlargement.
- *e*. A central tooth from an embryonic specimen.

Fig. 2. Patula Cooperi, W. G. B.
- *a*. Central and lateral.
- *b*. Outer marginals.

Fig. 3. Patula perspectiva, Say.

Fig. 4. Patula Idahoensis, Newc.

Fig. 5. Patula alternata, Say.
Fig. 6. Patula Hemphilli, Newc.
Fig. 7. Patula alternata, Say. Var. mordax, Shuttl.
Fig. 8. Patula Cumberlandiana, Lea.
Fig. 9. Patula solitaria, Say.
Fig. 10. Patula striatella, Anthony.

PLATE VIII.

a. Central and lateral teeth.
b. The last lateral tooth.
c. Inner marginal teeth.
d. Outer marginal teeth.

Fig. 1. Helix Texasiana, Mor.
Fig. 2. Helix Troostiana, Lea.
Fig. 3. Helix uvulifera, Shuttl.
Fig. 4. Helix espiloca, Rav.
Fig. 5. Helix Hazardi, Bl.
Fig. 6. Helix septemvolva, Say.
Fig. 7. Helix Febigeri, Bl.
Fig. 8. Helix pustula, Fér.
Fig. 9. Helix auriformis, Bl.
Fig. 10. Helix Mooreana, W. G. B.
Fig. 11. Helix fastigans, L. W. Say.
Fig. 12. Helix auriculata, Say.

PLATE IX.

Fig. 1. Helix Edvardsi, Bland.
    a. Central and first lateral.
    b. Marginal.
    c. Extreme marginal.
Fig. 2. Helix polygyrella, Bland. Same references.
Fig. 3. Helix Yatesi, J. G. Coop. Same references.
Fig. 4. Helix monodon, Rack. Same references.
Fig. 5. Helix germana, Gld. Same references.
Fig. 6. Helix hirsuta, Say.
    b. Transition from laterals to marginals.
Fig. 7. Helix stenotrema, Fér.
    a. Central and lateral teeth.
    b. Extreme marginals.
Fig. 8. Helix spinosa, Lea.
Fig. 9. Helix barbigera, Redf. References as in fig. 6.

PLATE X.

Fig. 1. Helix tridentata, Say.
Fig. 2. Helix palliata, Say.
  a. Central and first lateral.
  b. An outer lateral.
  c. A transition tooth between laterals and marginals.
  d. A marginal tooth.
Fig. 3. Helix Rugeli, Shuttl.
Fig. 4. Helix inflecta, Say.
Fig. 5. Helix fallax, Say.
Fig. 6. Helix Hopetonensis, Shuttl.
  b. Marginal teeth.
Fig. 7. Helix appressa, Say.

PLATE XI.

  a. Central and lateral.
  b. Inner marginal.
  c. Outer marginal.
  d. Transition from lateral to marginal.
Fig. 1. Helix albolabris, Say.
Fig. 2. Helix Wetherbyi, Bl.
Fig. 3. Helix Roemeri, Pfr.
Fig. 4. Helix Downieana, Bl.
Fig. 5. Helix Sayii, Binn.
Fig. 6. Helix Clarki, Lea.
Fig. 7. Helix exoleta, Binn.

PLATE XII.

Fig. 1. Helix elevata, Say.
Fig. 2. Helix Columbiana, Lea.
Fig. 3. Helix Mobiliana, Lea.
  b. Extreme marginals.
Fig. 4. Helix devia, Gld.
  a. Central and lateral tooth.
  b. An extreme lateral.
  c. Marginal teeth.
  d. The last marginal.
Fig. 5. Helix profunda, Say.
Fig. 6. Helix multilineata, Say.

Fig. 7. Helix clausa, Say.
 b. Marginal teeth.
 c. Extreme marginals.
Fig. 8. Helix dentifera, Binney.
 b. Marginal tooth.

PLATE XIII.

Fig. 1. Hemitrochus varians, Mke.
 a. Central and first lateral teeth.
 b, *c*. Marginal teeth.
Fig. 2. Helix griseola, Pfr. Same references.
Fig. 3. Helix Stearnsiana, Gabb.
 a. Group of central and lateral teeth.
 b. Group of teeth showing transition from laterals to marginals.
 c. A group of extreme marginal teeth.
Fig. 4. Helix Kelletti, Forbes.
 a. Central and first lateral tooth.
 b. Transition from laterals to marginals.
 c. Extreme marginal tooth.
Fig. 5. Helix lineata, Say. Same references as in fig. 1.
 b. Marginal tooth.
Fig. 6. Helix Newberryana, W. G. B. Same references as in fig. 4.
Fig. 7. Helix aspersa, Müll. Same references as in fig. 4.
Fig. 8. Helix fidelis, Gray. Same references as fig. 4.
Fig. 9. Helix infumata, Gld.
 a. Central and first lateral tooth.
 b, *c*. Transition teeth from different parts of the membrane.
 d. Extreme marginal teeth.

PLATE XIV.

a. Central and lateral teeth.
b. Transition from laterals to marginals.
c. Inner marginal teeth.
d. Outer marginal teeth.

Fig. 1. Helix tudiculata, Binn.
Fig. 2. Helix arrosa, Gld.
Fig. 3. Helix ruficincta, Newc.
Fig. 4. Helix Traski, Newc.
Fig. 5. Helix sequoicola, J. G. Coop.

Fig. 6. Helix Ayresiana, Newc.
Fig. 7. Helix redimita, W. G. B.
Fig. 8. Helix Nickliniana, Lea.
Fig. 9. Helix ramentosa, Gld.
8. The eighth tooth—an outer lateral.
Fig. 10. Helix exarata, Pfr.

Plate XV.

a. Central and lateral teeth.
b. Inner marginal tooth.
c. Outer marginal tooth.
Fig. 1. Macroceramus Gossei, Pfr.
Fig. 2. Pupa rupicola, Say.
Fig. 3. Succinea avara, Say.
Fig. 4. Succinea obliqua, Say.
Fig. 5. Stenogyra decollata, Lin.
Fig. 6. Succinea effusa, Shuttl.
Fig. 7. Bulimulus dealbatus, Say.
Fig. 8. Stenogyra subula, Pfr.
Fig. 9. Cœcilianella subcylindrica, Lin.
Fig. 10. Succinea campestris, Say.
Fig. 11. Succinea lineata, W. G. B.
Fig. 12. Pupa fallax, Say.

Plate XVI.

Jaw of:—
Fig. 1. Stenogyra subula, Pfr.
Fig. 2. Arion hortensis, Fér.
Fig. 3. Vitrina limpida, Gld.
Fig. 4. Helix Newberryana, W. G. B.
Fig. 5. Ferussacia subcylindrica, L.
Fig. 6. Hemphillia glandulosa, Bl. and Binn.
Fig. 7. Pupa rupicola, Say.
Fig. 8. Helix aspersa, Müll.
Fig. 9. Prophysaon Hemphilli, Bl. and Binn.
Fig. 10. Helix Yatesi, J. G. Cooper.
Fig. 11. Helix polygyrella, Bl. and J. G. Coop.
Fig. 12. Bulimulus sufflatus, Gld.
Fig. 13. Orthalicus undatus, Brug.
Fig. 14. Helix griseola, Pfr.

PLATE XVII.

Central, lateral, and outer marginal teeth of:—

Fig. 1. Zonites multidentatus, Binn.
Fig. 2. Zonites suppressus, Say.
Fig. 3. Zonites indentatus, Say.
Fig. 4. Zonites arboreus, Say.
Fig. 5. Zonites fulvus, Drap.
Fig. 6. Zonites viridulus, Mke.
Fig. 7. Zonites nitidus, Müll.
Fig. 8. Zonites milium, Morse.
Fig. 9. Zonites ferreus, Morse.
Fig. 10. Veronicella Floridana, Binn.
Fig. 11. Succinea Sillimani, Bland.

PLATE XVIII.

a. Central and lateral teeth.
b. Transition from laterals to marginals.
c. Inner marginal teeth.
d. Outer marginal teeth.

Fig. 1. Helix Wheatleyi, Bland.
Fig. 2. Helix thyroides, Say.
Fig. 3. Helix Pennsylvanica, Green.
Fig. 4. Helix loricata, Gld.
Fig. 5. Helix Mitchelliana, Lea.
Fig. 6. Helix pulchella, Müll.
Fig. 7. Helix labyrinthica, Say.
Fig. 8. Helix Townsendiana, Lea.
Fig. 9. Helix asteriscus, Morse.
Fig. 10. Helix obstricta, Say.

NOTE.—The following typographical errors in the earlier pages of this paper should be carefully corrected:—

p. 141, third line from bottom, for *Paluta* read *Patula*.
p. 146, line 11, for former read latter.
p. 147, line 20, for *Anaderus* read *Anadenus*.
p. 148, line 12, for *Simpulopsus* read *Simpulopsis*.
p. 153, line 17 from bottom of right hand column, for Terussacia read Ferussacia.
line 16, for Cæcilianella read Cœcilianella; also on p. 186.
p. 154, line 11 of left hand column, for Columbianaus read Columbianus.
p. 155, note, for *ptychoptora* read *ptycophora*.

p. 180, line 13, for 5 read 8.

p. 191, line 5 from bottom, for Colkett read Calkins.

p. 165, line 19, *Z. cerinoideus*. Jaw as usual. Teeth 34—1—34, with 9 perfect laterals. Charleston, S. C. (W. G. Mazyck.)

p. 171. Note. *Z. cerinoideus* also has these characteristics of *Zonites*.

p. 176, line 15, add : excepting in the absence of the peculiar inner side cutting point of that species.

p. 186. Cœcilianella. Since the above was printed, I have had an opportunity, thanks to Mr. Bland, of examining the jaw and lingual membrane of *C. Gundlachi* of St. Martin. The jaw has decided, numerous, broad, flat, slightly separated ribs, denticulating either margin.

In the plates the inner cutting point should have been bifid in pl. X. fig. 1, 16th tooth. (The fourth figure from the right is the 10th tooth.) Fig. 3, *d*. Pl. XI. fig. 1, *b*. Pl. XII. fig. 1, 31st tooth.

Helix ruficincta, pl. XIV. fig. 3. Another membrane has cutting points on all the laterals.

Helix exoleta. Two of four membranes recently examined have side cutting points to outer laterals; the inner cutting point of marginals are also bifid.

ON THE LINGUAL DENTITION AND GENITALIA OF PARTULA AND OTHER PULMONATA.

BY W. G. BINNEY.

I owe to the kindness of Dr. W. D. Hartman, of West Chester, Pennsylvania, the opportunity of examining numerous species of *Partula.* The specimens were received by him directly from Mr. Garrett. Their identification is that of the latter, and may be relied upon on account of his relations with Mr. Pease. Of their value as distinct species, however, I have nothing to say. So labelled were *Partula fusca*, Pease; *P. citrina*, Pease; *P. planilabrum*, Pease; *P. abbreviata*, Pease; *P. umbilicata*, Pease; *P. bilineata*, Pease; *P. amanda; P. virginea*, Pease; *P. gracilis.* Each of these were represented by several specimens still remaining in their shells. Each species was in a separate bottle, great care being taken to preserve their identity and pevent intermingling of species.

In addition to the above nine so-called species, there was one large bottle containing many specimens of the following: *Partula rosea*, Brod.; *P. formosa*, Pease; *P.? lugubris; P. varia*, Brod.; *P. compacta*, Pease; *P. Garretti*, Pease; *P.? dentifera*, Pease; *P. crassilabris*, Pease; *P. Hebe*, Pfr.; *P. protea*, Pease; *P. globosa*, Pease; *P. approximata*, Pease; *P. turgida*, Pease; *P. faba*, Martyn. As the species of the above lot were not separately indicated, the specimens are of value only as throwing light upon the generic characters of *Partula.* Especially as proving the constancy of the peculiar dentition of the lingual membrane, they serve an excellent purpose. To this end I have examined the membrane of all of the specimens in the bottle. The result of the examination will be given below.

The external characters of all the species agree. The animal is blunt before. The tail is long and gradually acuminated. There is no caudal mucus pore, no parallel furrows along the side of the foot, no distinct locomotive disk. The labial processes and the collar seem unusually developed. The anal and respiratory orifices are situated as usual in the shell-bearing Geophila. The genital orifice is close behind and below the right eyepeduncle. The tentacles are present in all the species, protruding in many specimens as fully as the eyepeduncles, in others inverted, but plainly visible on opening the head, and their position indicated exteriorly by a depression on the surface so plainly that I wonder at their having been overlooked by Férussac.

I have observed nothing remarkable in the nervous, respiratory, or alimentary systems.

The jaw, as already stated by me (Ann. Lyc. of Nat. Hist. of N.Y., XI. 45), is very thin, transparent, light horn-colored; slightly arcuate, its ends often gradually attenuated; in some specimens is a transverse, arched line of reënforcement above, but not parallel to, the cutting margin; there is no appearance of a median projection to the cutting margin; the whole anterior surface, even to the ends, is furnished with delicate, narrow, separated ribs, of the type well known in *Cylindrella*, *Macroceramus*, *Pineria*, *Gæotis*, *Amphibulima*, and many species of *Bulimulus*, their ends decidedly breaking the continuity of either margin: these ribs run obliquely to the median line of the jaw, so that at the centre they form a triangular space over which are (in one specimen of *P. gracilis*, some ten) ribs of unequal length, which do not reach the lower margin; there is, however, no distinct triangular compartment or separate piece, as in *Liguus* and *Orthalicus*. I have found this form of jaw in *P. fusca*, *citrina*, *planilabrum*, *abbreviata*, *umbilicata*, *amanda*, *virginea*, *bilineata*, and *gracilis*. I have not observed the jaw in all of the specimens of the species enumerated on p. 244, but in many of them which I have examined it proved the same as described above. The jaw differs in the various species in the more or less attenuation towards the ends, and also in the number of the ribs, thus in *virginea* and *gracilis* there are over 60, in *bilineata* I found but 50, while in one of the unnamed individuals I found only about 36. This last I have figured (pl. XIX., fig. 5) to show the general form of the jaw. The character of the ribs is better shown in the more enlarged view of the end of the jaw of *P. virginea* (fig. 11), while the disposition of the ribs at the centre of the jaw is shown in fig. 6 of *P. gracilis*.

The lingual membrane is broad. The central teeth (pl. XIX., fig. 4, of that of *P. amanda*) have a base of attachment long and narrow, squarely reflected above, the lower edge incurved, with slightly produced lateral expansions; the reflection is large and stout, with obsolete side cusps bearing decided, triangular cutting points, and a stout middle cusp bearing a stout cutting point which reaches to the lower edge of the base of attachment. The lateral teeth are longer and broader than the central tooth; they are unsymmetrical by the suppression of the inner cusp and cutting point, and the lower half of the base of attachment being thrown off towards the outer edge of the membrane, though its inner lower lateral expansion is not suppressed; the outer side cusp is well developed and bears a short distinct cutting point; the inner cusp is very stout and bears a very stout cutting point extending slightly beyond the lower edge of the base of attachment. The change from the lateral to the marginal teeth is formed by the lesser size of the reflected portion and the greater development of the inner cutting point, as well as by the blunt bifurcation of the outer cutting point. The marginal teeth have their base of attachment long and narrow, quadrangular, curving outward, prolonged above the reflection, which is small, but bears a highly developed cutting point obliquely and bluntly bicuspid on its outer edge, the inner division much the larger. The number of perfect laterals varies somewhat. I counted seven in *citrina*, eleven in *planilabrum*, ten in *abbreviata* and *amanda*, eight in *umbilicata*, *virginea*, and *bilineata*, five only in *gracilis*. The number of marginal teeth also varies, but they are numerous in all the species; in *virginea* I counted over one hundred and twenty. Excepting that some of the membranes had narrower teeth than others, I found no difference in them. They all agree (including those of the species named on p. 244) with the figure given by Heynemann (Mal. Blatt. 1867, t. i. fig. 1-1a.) of the dentition of *P. lirata.*

The genital system of one of the undetermined specimens is given on pl. XIX., fig. 1. The ovary (*ov.*) is small and stout; the epididymis (*ep.*) is short and greatly convoluted at the end nearer the oviduct; the testicle (*t.*), composed of short cœca, is small and embedded in the upper lobe of the liver in the very apex of the shell; the oviduct (*ovid.*) is long, convoluted; the vas deferens (*v. d.*) enters the prostate high up on the oviduct, not at its lower end, as usual; it runs down to the external orifice, then up to near the end of the penis sac, where it enters; the vagina (*v.*) is long, greatly swollen at the entrance of the duct of the genital bladder; the last mentioned organ (*g. b.*) is small, with a short duct which enlarges greatly before entering the vagina; the penis sac (*p. s.*) is large, long, bluntly terminating, with a decided constriction about its centre. In the other species examined, the retractor muscle is inserted at the end of the penis sac. The same general arrangement is found in the other species examined, *bilineata* (fig. 10), *fusca* (fig. 9), *virginea* (fig. 8), *umbilicata* (fig. 7), and in *abbreviata*, *citrina*, *planilabrum*, *amanda*. In *P. virginea* the constriction of the penis sac is much narrower and longer; the upper portion might be considered rather as a swelling of the vas deferens. In most of the specimens examined there were well formed shells of too full whorls in the oviduct, leading me to believe the genus viviparous. Thus I found embryonic young (usually only two) in *planilabrum*, *abbreviata*, *umbilicata*, *bilineata*, *amanda*, and *virginea*. Those less grown were enveloped in a sack. In *gracilis*, however, I found five white, calcareous eggs. They contained, however, shells of two whorls, so that even if this species actually lays the egg, it can only be at the moment the young animal is ready to break it. In many of the undetermined species, also, I found well formed eggs, and in some of them there were these eggs, and also embryonic young not protected by eggs. I suspect, therefore, that the young is actually brought forth living in *all cases*.

This closes my account of *Partula*. I add descriptions of several species of Pulmonata, whose dentition has not yet been published. As each lingual membrane is illustrated by a figure, I have not considered it necessary to give a detailed description.

Macrocyclis euspira, Pfr. (*Hyalina* of von Martens, p 72.)

Extracted from a dry specimen in the cabinet of Mr. Swift by Mr. Thomas Bland. Ann. L. N. H. N. Y., XI. 73.

Jaw low, crescentic, ends pointed; cutting margin with a decided, sharp median projection.

Lingual membrane long and narrow. Teeth arranged as in *Macrocyclis* (see ante, p. 158). There are, however, no transition teeth as in the American species, all the side teeth being true marginals of the aculeate type. Teeth 30—1—30 (pl. XXI., fig. 3). The centrals are deeply emarginate at the upper edge of their base of attachment, and have expanded lower lateral angles; they have also a well-marked simple median cusp with a decided cutting point.

The species is placed by Von Martens in *Ammonoceras*, a subgenus of *Hyalina*.

Nanina subcircula, Mousson.

Raiatea, Society Islands, Mr. Garrett to Dr. W. D. Hartman.

Jaw not observed.

Teeth (pl. XX., fig. 1) with obsolete side cusps, but distinct cutting points on the centrals. Laterals unsymmetrical as usual by the suppression of the inner cutting point, and inner lower lateral expansions to the base of attachment. Marginals aculeate, bifid.

The species is viviparous.

Endodonta tumuloides, Garrett.

Raratonga I., Cook's Isle. Received from Dr. W. D. Hartman, who received it from Mr. Garrett.

Teeth 17—1—17, with about 7 perfect laterals (pl. XXI., fig. 6). The base of attachment of the centrals is subequilateral. There are distinct side cutting points and cusps. The median cusp is long. Laterals unsymmetrical as usual. Transition formed as usual. Marginals low, wide, with one long, large, bifid inner cutting point and one small side cutting point.

Jaw not observed.

Helix astur, Souv.

New Caledonia, Mr. Thomas Bland.

Jaw (pl. XX., fig. 11) low, wide, slightly arcuate; ends scarcely attenuated, blunt; anterior surface without ribs; a wide, blunt, median projection to the cutting edge; a line of reënforcement running above, and parallel to, the cutting margin; a strong muscular attachment to the upper margin.

Lingual membrane (pl. XX., fig. 12) with 30—1—30 teeth, with about 9 perfect laterals. Centrals (*a*) with square base of attachment, well-developed side cusps and cutting points; laterals same as centrals, but unsymmetrical as usual; transition to marginals formed as usual (*b*); marginals (*c*) low, wide, with one inner, long, broad, bifid cutting point, and one outer, small cutting point; those figured (*c*) are extremes.

Helix (*Thelidomus*) auricoma, Fér.

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw arched, with blunt, scarcely attenuated ends; 12 broad ribs distributed over the whole anterior surface and denticulating either margin; no median projection to the cutting margin.

Lingual membrane (pl. XXI., fig. 5), with 42—1—42 teeth, of which about 25 may be called laterals, but the change to marginals is hardly marked, these last differing only in being smaller, in having a more square base of attachment, and in having more obtuse and more proportionally developed cutting points; there is no splitting of the inner cutting point of the marginals. The centrals have subobsolete side cusps, but decided side cutting points; the central cusp is short and stout, the base of attachment has greatly expanded lower lateral angles. Laterals like the centrals, but unsymmetrical as usual.

The dentition of this species resembles that of *provisoria* and *notabilis* of the same subgenus.

The genitalia are figured on pl. XIX., fig. 3. The penis sac (*p. s.*) is stout, rounded, with long, pointed apex; the vas deferens (*v. d.*) enters it below the apex; the retractor muscle (*r.*) is inserted in the vas deferens just before it enters the penis sac. The genital bladder (*g. b.*) is short, cylindrical, with blunt end; its duct is short and small. The penis sac enters the vagina opposite the entrance of the genital bladder.

Helix (*Carocolus*) **sagemon, Beck.**

Cuba. Mr. Arango to Mr. T. Bland.

Jaw high, arcuate, ends rapidly but slightly attenuated, blunt; cutting margin with broad, blunt, median projection; no anterior ribs.

Lingual membrane (pl. XXI., fig. 4) very long and narrow, with 36—1—36 teeth, the transverse rows of teeth being unusually oblique. The change from laterals to marginals is so gradual that it is difficult to say how many of the former there are. Centrals with base of attachment long, constricted at the middle, expanded above and with greatly produced lower lateral expansions; reflection large, with obsolete side cusps and no side cutting points, and with a very broad, short median cusp, bearing a short, widely expanded, square cutting edge (as it cannot be called a *point*). Laterals like the centrals, but unsymmetrical as usual, and with an unsymmetrical cutting edge larger than in the central tooth. The cutting edge becomes more developed as the teeth pass off laterally, in proportion to the base of attachment and the cusp also. Thus the marginals become formed without any splitting of the inner cutting point, or any development of a side cusp and cutting point. This is better shown in the figures than can be expressed in words.

The genitalia of this species is figured on pl. XIX., fig. 2. The testicle (*t*) is small and imbedded in the upper lobe of the liver; the epididymis (*ep.*) is long and greatly convoluted near its junction with the oviduct; the accessory gland (*acc.*) is composed of several tubular cæca of unequal length; the ovary (*ov.*) is very large and sabre-shaped; the oviduct (*ovid.*) is narrow, but slightly convoluted; the genital bladder (*g. b.*) is large, globular, with a short, stout duct entering the vagina at about the middle of its length; the penis sac (*p. s.*) is large, with a central constriction, tapering towards the apex, where the vas deferens (*v. d.*) enters, and bearing the insertion of the retractor muscle (*r.*) below its apex; it enters the cloaca close to the external orifice.

Helix (*Caracolus*) **Arangiana,** Poey.

Cuba. Mr. Arango to Mr. Thomas Bland.

Jaw (pl. XXI., fig. 2) greatly arched, ends blunt, scarcely acuminated; anterior surface without ribs; cutting margin with a blunt median projection.

Lingual membrane very long and narrow (pl. XXI., fig. 1), with 33—1—33 teeth, of same type as in *H. sagemon* (see above). The lower edge of the base of attachment appears delicately fringed.

Genitalia as in *H. sagemon* (see above).

Helix (*Pomatia*) **Sieboldtiana,** Pfr.

Japan. Received from Dr. W. D. Hartman.

Jaw high, arched, ends but little attenuated, blunt; anterior surface with eight stout, separated ribs, denticulating either margin; no median projection to the cutting margin.

Lingual membrane long and narrow (pl. XXI., fig. 8); teeth 39—1—39, with 21 perfect laterals; centrals with base of attachment long, narrow, the lower lateral angles somewhat expanded, but blunt; median cusp long, stout, cutting point stout, blunt, not reaching the lower edge of the base of attachment; side cusps obsolete; no side cutting points. Laterals like the centrals, but longer and wider, and unsymmetrical as usual; the fifteenth lateral has a side cutting point. The transition to marginals formed as usual by the greater proportional development and splitting of the cutting point. Marginals low, wide, with one broad, oblique, bluntly bifid cutting point, and one short, side cutting point.

The species is placed by Von Martens in *Acusta*, a subgenus of *Nanina*, judging from shell alone.

Helix convicta, Cox.

Australia. Received from Dr. Cox by Dr. W. D. Hartman.

Jaw high, arcuate, thick; ends but little attenuated, blunt; no median projection to cutting edge; anterior surface with 7 separated, stout ribs.

Lingual membrane (pl. XXI., fig. 7) with 30—1—30 teeth, with 10 laterals. The centrals and inner laterals have no side cutting points. Transition to marginals as usual (see last species). Marginals low, wide, with one short, broad, bifid inner cutting point, and one small, side cutting point.

Helix (*Dorcasia*) **pyrozona**, Phil.

" Outside the great wall of China." Lieut. Wild, U. S. N., to Dr. W. D. Hartman.

Jaw as in Pomatia (see above, *H. Sieboldtiana*). Ribs few, stout.

Lingual membrane (pl. XX., fig. 8), with 28—1—28 teeth, with 10 perfect laterals. It is difficult to distinguish any cutting points on the obsolete side cusps of centrals and inner laterals. The general characters of the teeth are as in *H. Sieboldtiana* (see above).

Stenogyra hasta, Pfr.

Cuba. Received from Mr. Bland.

Jaw (pl. XX., fig. 2) low, arcuate, ends somewhat attenuated, blunt; no median projection to cutting margin; anterior surface with numerous delicate striæ.

Lingual membrane (pl. XX., fig. 3) as usual in the genus (see ante, p. 187). There are 18—1—18 teeth.

The species was formerly described as a *Balea*. This examination of the jaw and dentition shows its correct position to be in *Stenogyra*.

Macroceramus turricula, Pfr.

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw as usual in the genus (see ante, p. 223). Ribs 35.

Lingual membrane (pl. XX., fig. 9) as in *M. Gossei*, Pfr. (see above), not as in *Cylindrella.*

Cylindrella (*Gongylostoma*) **elegans**, Pfr.

Habana, Cuba. Mr. Arango to Mr. Thomas Bland.

Lingual membrane (pl. XX., fig. 6) with 12—1—12 teeth, arranged as usual in the genus (see ante, p. 222). The base of attachment is shorter and stouter, the outer cusp of the laterals is larger and on a shorter and stouter pedicle than in *Cylindrella scæva*, figured on page 222. There are no distinct marginals, the teeth slightly and gradually changing in size as they pass off laterally, until in the extremes the two cutting points become of almost equal size and the outer one ceases to be on a distinct pedicle; the base of attachment also in the extremes is almost square.

This membrane is of interest, being the first described of the section *Gongylostoma*, whose dentition was unknown to Messrs. Crosse and Fischer.

Cylindrella cyclostoma, Pfr.

Mr. Arango to Mr. Bland. Lomas de Camoa, Cuba.

Jaw as usual in the genus, with over 70 delicate ribs (see ante, p. 222).

Lingual membrane long and narrow, as usual in the genus. Laterals 2, marginals about 8, these and centrals of same type as those figured by Messrs. Fischer and Crosse (Journal de Conchyliologie, 2d s., X.), for the group *Cylindrella*, s. s., as in *Cylindrella costata*, pl. IV., fig. 2.

The first marginal, however, surely is of same type as the laterals, though much smaller and somewhat modified in form. It appears like a transition from the one to the other.

Cylindrella (*Thaumasia*) Humboldtiana, Pfr.

Cuba. Mr. Arango to Mr. Bland.

Lingual membrane long and narrow, as usual in the genus. Teeth 8—1—8 of same type as figured by Messrs. Fischer and Crosse for *C. rosea* (Journ. de Conch., XVIII, 1870, pl. IV. fig. 4). The species belongs, therefore, to their group *Thaumasia*.

The jaw is as usual in the genus, with about 100 ribs.

EXPLANATION OF THE PLATES.

PLATE XIX.

t. Testicle.
e. Epididymis.
ac. Accessory gland of last.
ov. Ovary.
ovid. Oviduct.

p. Prostate.
v. d. Vas deferens.
p. s. Penis sac.
r. Retractor muscle of last.
or. External orifice of genitalia.
g. b. Genital bladder.
v. Vagina.

Fig. 1. Genitalia of Partula.
Fig. 2. " H. Sagemon, Beck.
Fig. 3. " H. auricoma, Fér.
Fig. 4. Lingual dentition of Partula amanda, Pease. The last figure is the extreme marginal in profile.
Fig. 5. Jaw of Partula.
Fig. 6. " " Partula gracilis, Pease.
Fig. 7. Genitalia of Partula umbilicata, Pease.
Fig. 8. " " P. virginea, Pease.
Fig. 9. " " P. fusca, Pease.
Fig. 10. " " P. bilineata, Pease.
Fig. 11. Jaw of P. virginea, Pease.

PLATE XX.

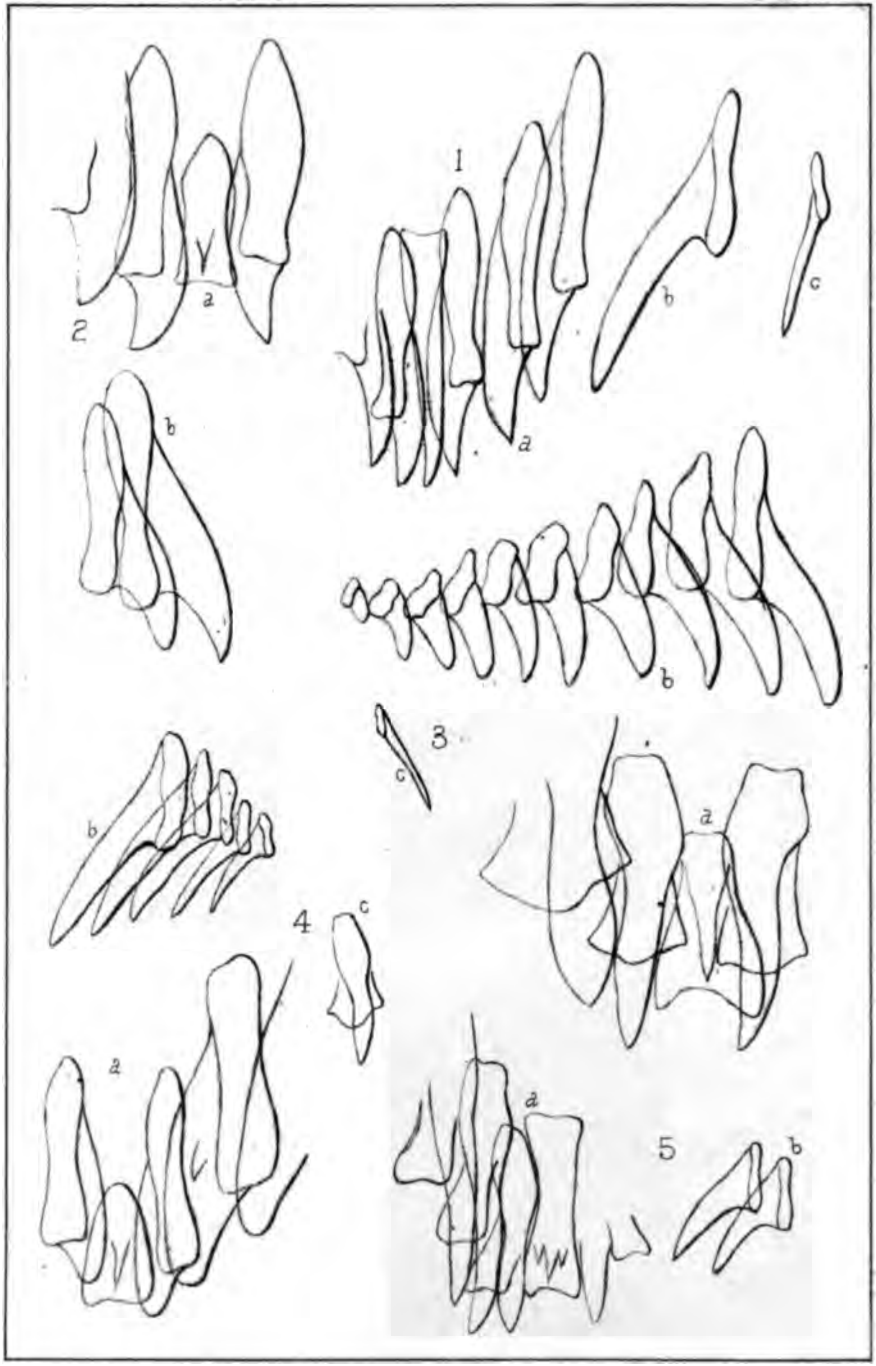
Lingual dentition and jaw of:—
Fig. 1. Nanina subcircula, Mousson.
Fig. 2, 3. Stenogyra hasta, Pfr.
Fig. 4. Helix vortex, Pfr. (See p. 180.)
Fig. 5. Helix septemvolva, Say. (See p. 203.)
Fig. 6. Cylindrella elegans, Pfr.
Fig. 7. Succinea Stretchiana, Bland. (See p. 232.)
Fig. 8. Helix pyrozona, Phil.
Fig. 9. Macroceramus turricula, Pfr.
Fig. 10. Holospira Goldfussi, Pfr. (See p. 183.)
14. The extreme figure is drawn from another portion of the membrane, where the cusps are more highly developed.
Fig. 11, 12. Helix astur, Souv.

PLATE XXI.

Jaw and lingual dentition of:—
Fig. 1, 2. Helix Arangiana, Poey.
Fig. 3. Macrocyclis euspira, Pfr.

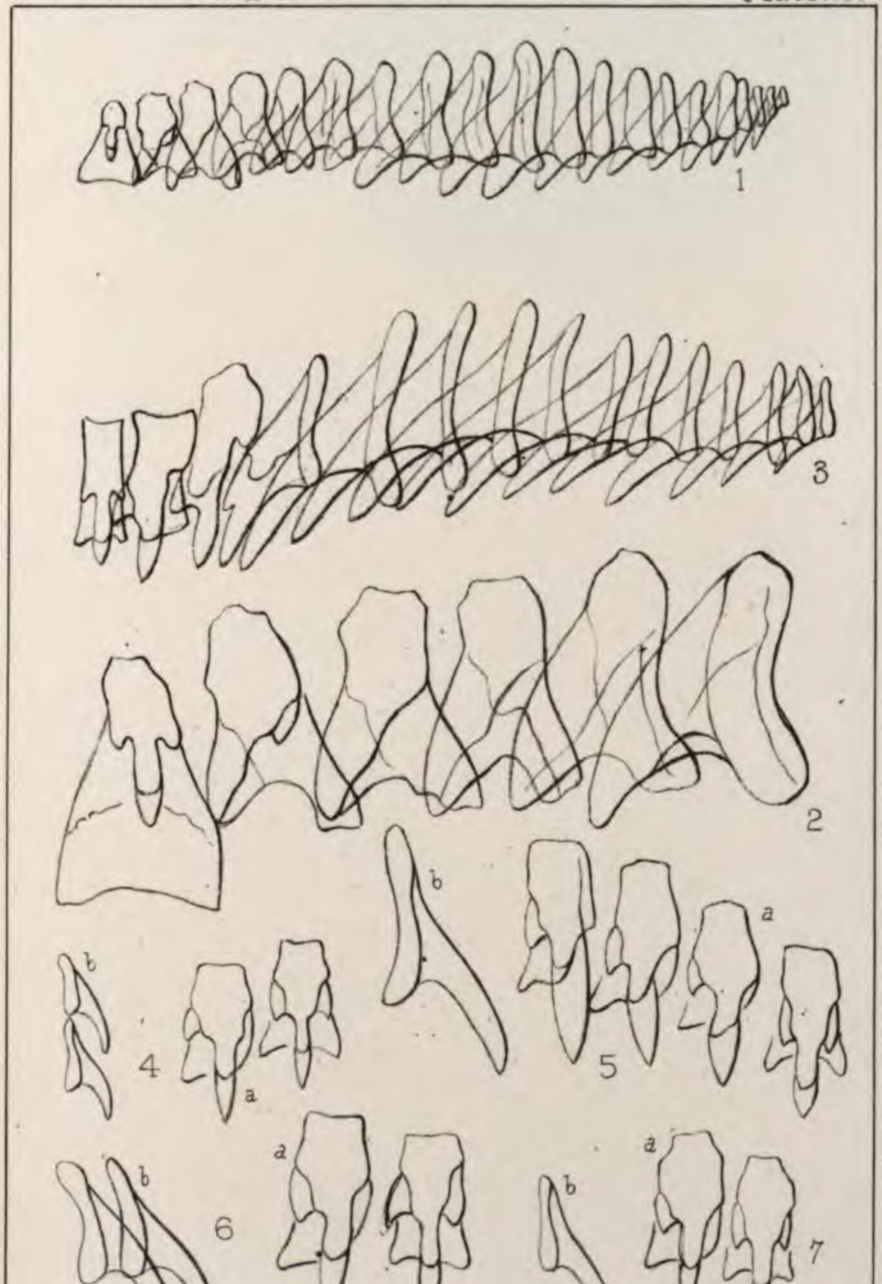
Fig. 4. Helix Sagemon, Beck.
Fig. 5. Helix auricoma, Fér.
Fig. 6. Endodonta tumuloides, Garrett.
Fig. 7. Helix convicta, Cox.
Fig. 8. Helix Sieboldtiana, Pfr.
Fig. 9. Zonites minusculus, Binney. (See p. 166.)

Proc. Ac. Nat. Sc. Phila. 1875. Plate. I.



W. G. B. del. J. H. Bufford's Sons Lith Boston.

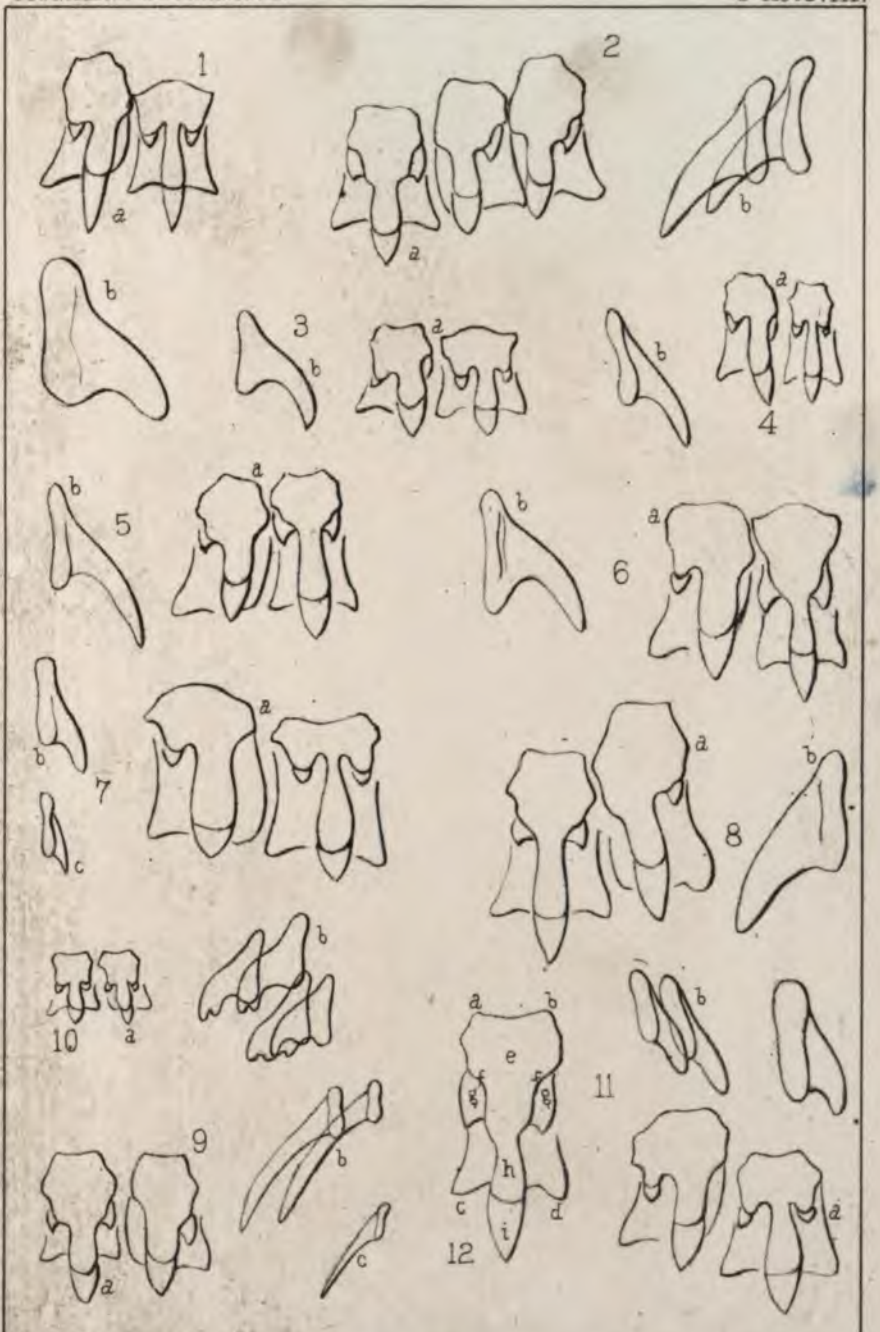
1. Glandina truncata, *Say.* 3. M. concava, *Say.*
2. Macrocyclis Duranti, *Newc.* 4. M. Vancouverensis *Lea*
5. M. Voyana *Newc.*



W. G. B. del.

J. H. Bufford's Sons Lith Boston.

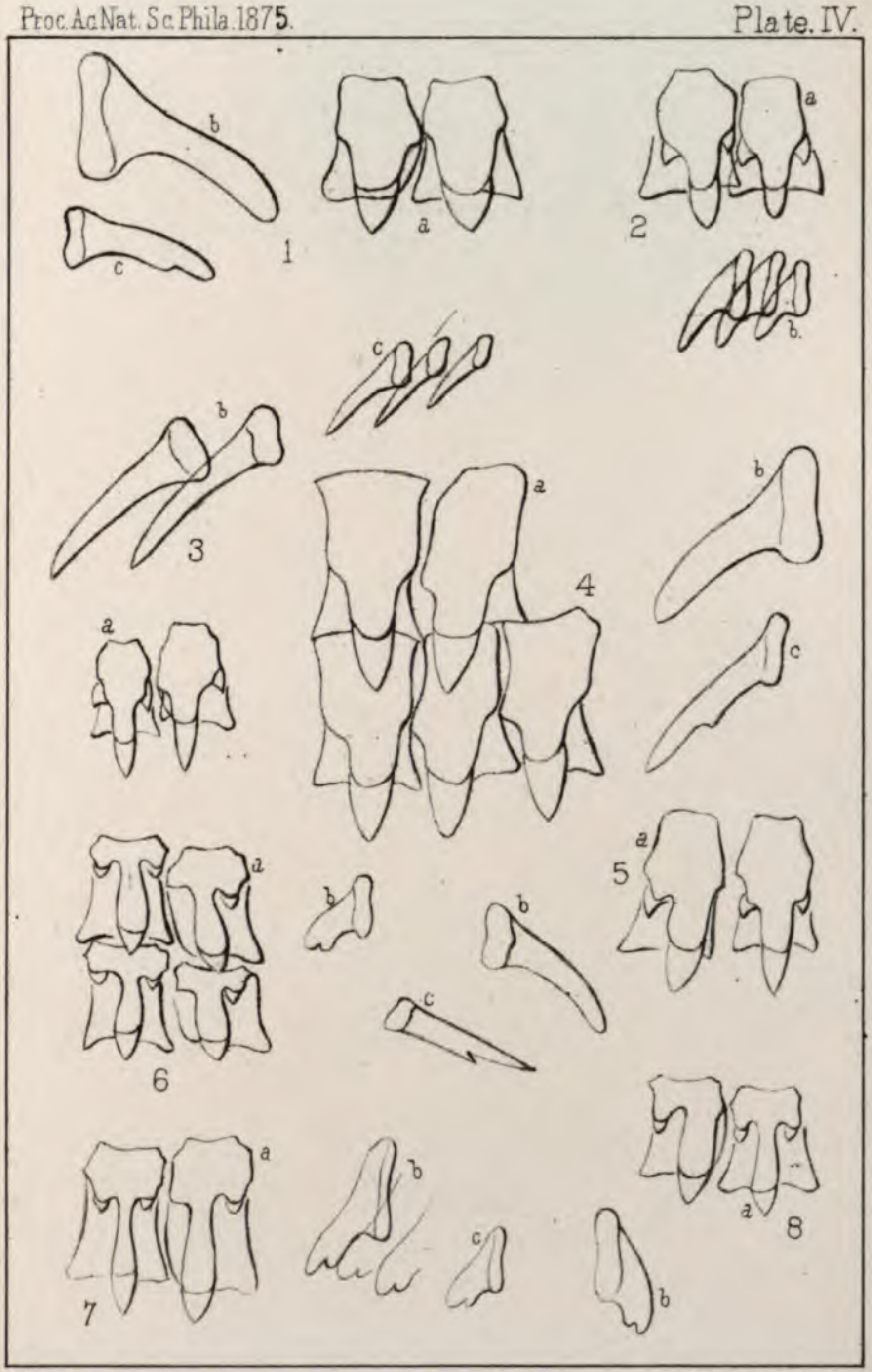
1 2. Zonites laevigatus, *Pfr.*
3. Z. cellarius, *Müll.*
4. Z. friabilis, *W.G.B.*
5. Z. inornatus, *Say.*
6. Z. capnodes, *W.G.B.*
7. Z. fuliginosus, *Grif.*



W. G. B. del.

J. H. Bufford's Sons Lith. Boston.

1. Z. gularis *S.*
2. Z. sculptilis *Bl.*
3. Z. limatulus *Ward.*
4. Z. capsella *Gld.*
5. Z. Ellioitti, *Red.*
6. Z. demissus, *B.*
7. Z. lasmodon, *P.*
8. Z. intertextus, *S.*
9. Z. internus, *S.*
10. Z. Gundlachi, *Pfr.*
11. Z. ligerus, *S.*
12. Z. capnodes, *WGB.*

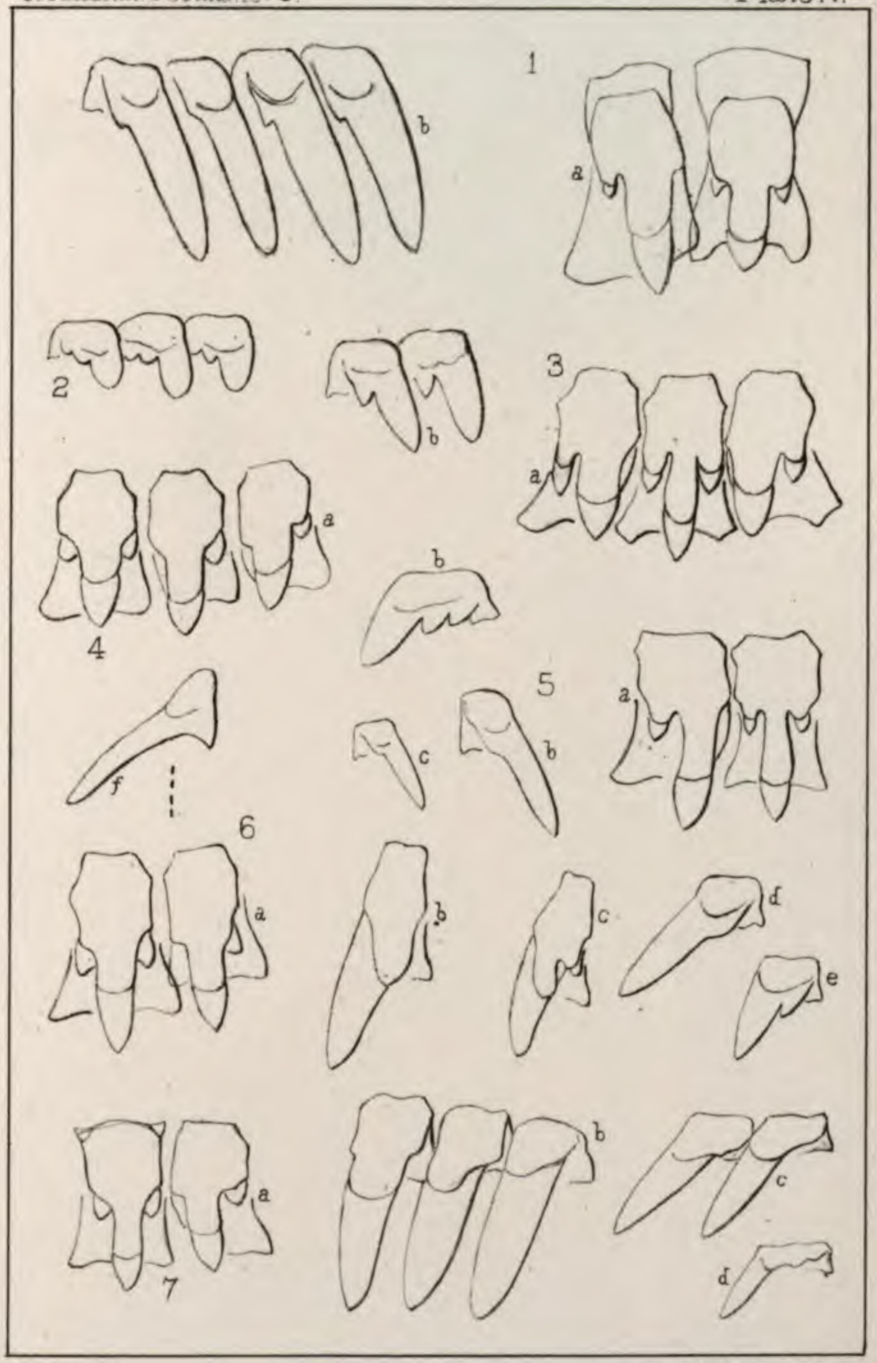


W. G. B. del.

J.H.Bufford's Sons Lith. Boston

1. *Limax flavus*, *Lin.*
2. *L. Hewstoni*, *J.G.C.*
3. *L. agrestis*, *Lin.*
4. *L. maximus*, *Lin.*
5. *L. campestris*, *Binn.*
6. *Vitrina Pfeifferi*, *Newc.*
7. *V. exilis*, *Mor.*
8. *V. limpida*, *Gld.*

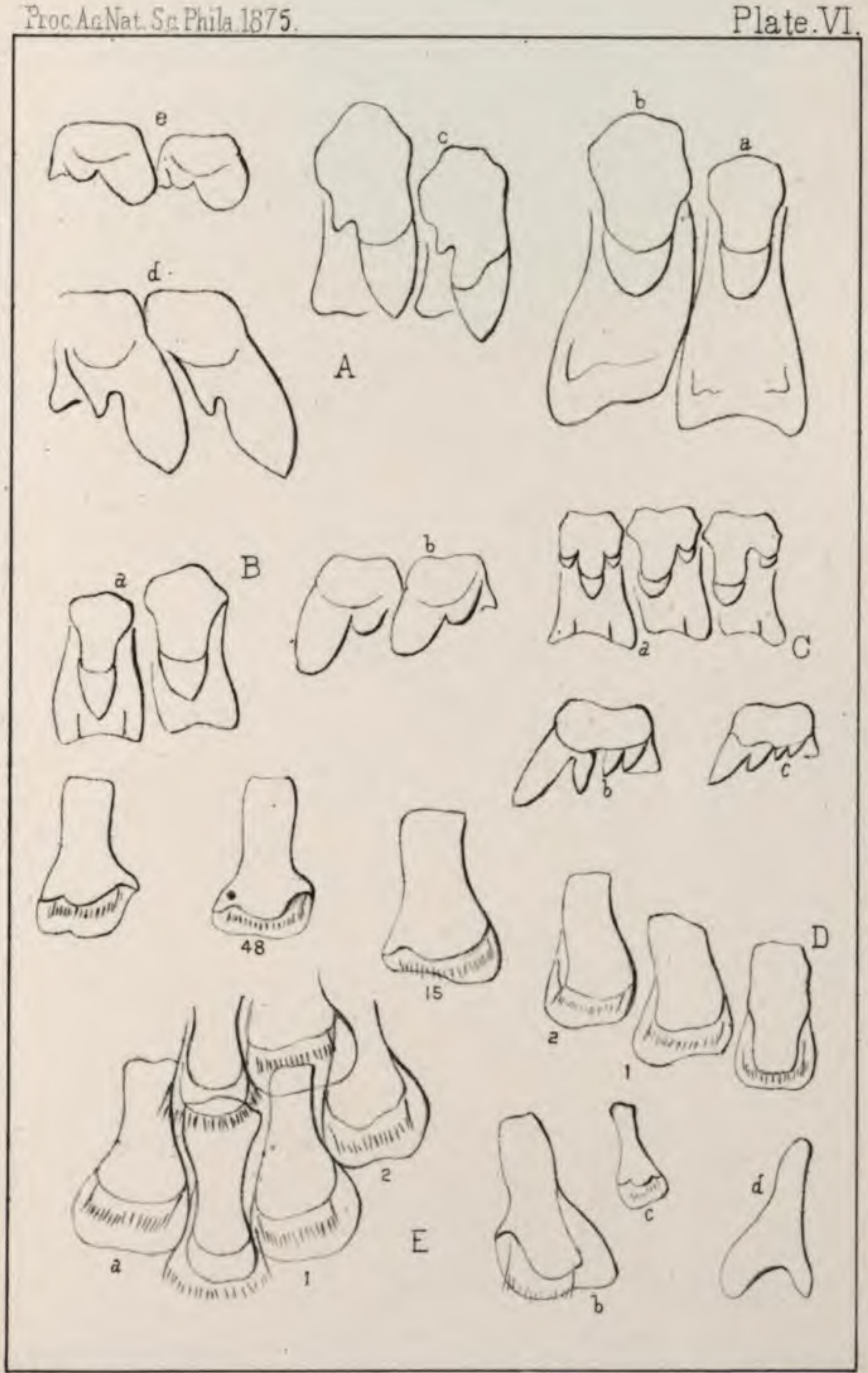
Plate V.



W.G.B. del.

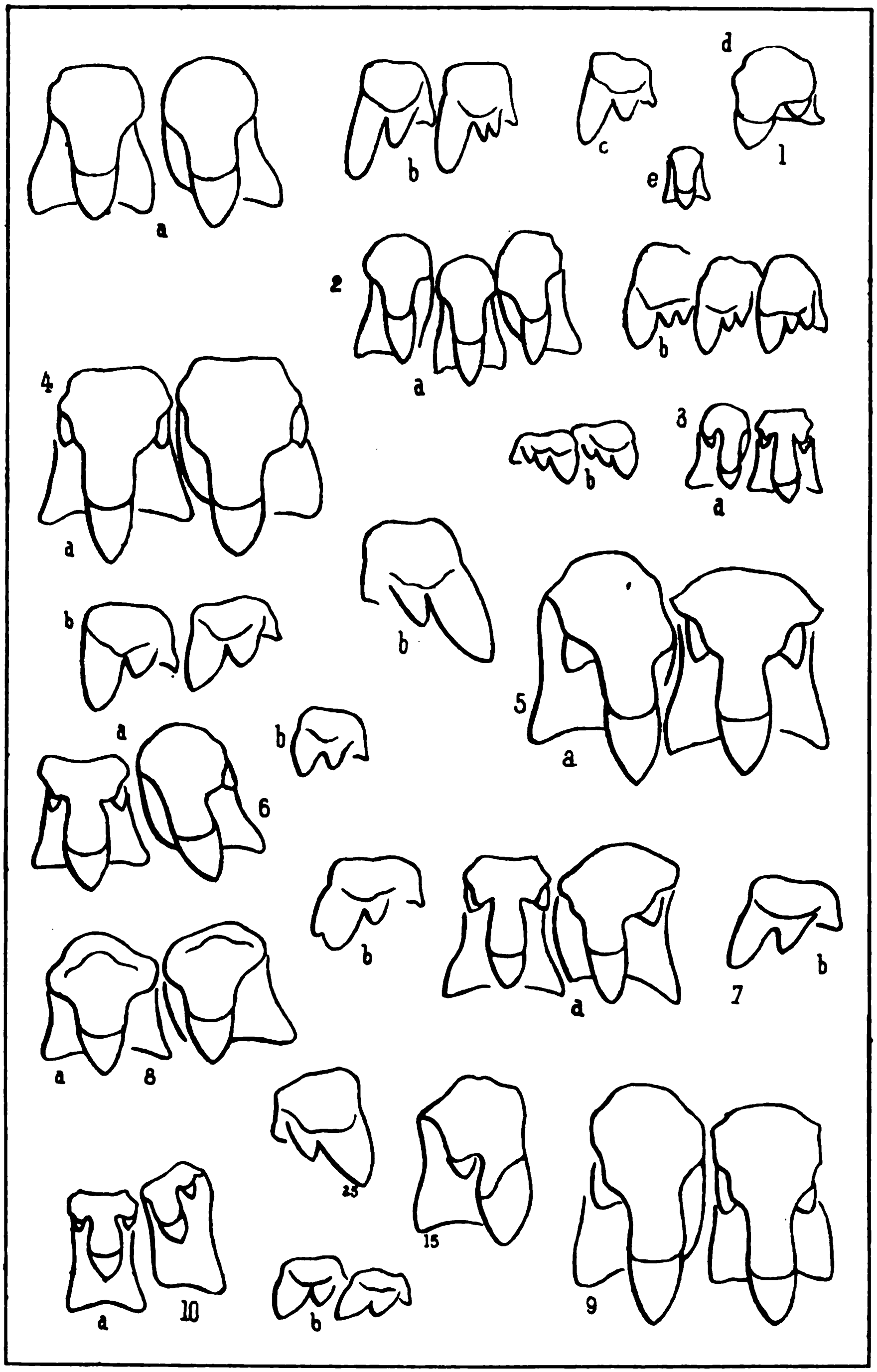
J.H.Bufford's Sons Lith Boston.

1. Ariolimax Californicus, *J.G.Coop.*
2.3. A. niger, *J.G.Coop.*
4. Prophysaon Hemphilli, *Bl.& Binn.*
5. Arion hortensis, *Fér.*
6. Ariolimax Columbianus, *Gld.*
7. Hemphillia glandulosa *Bl.& Binn.*



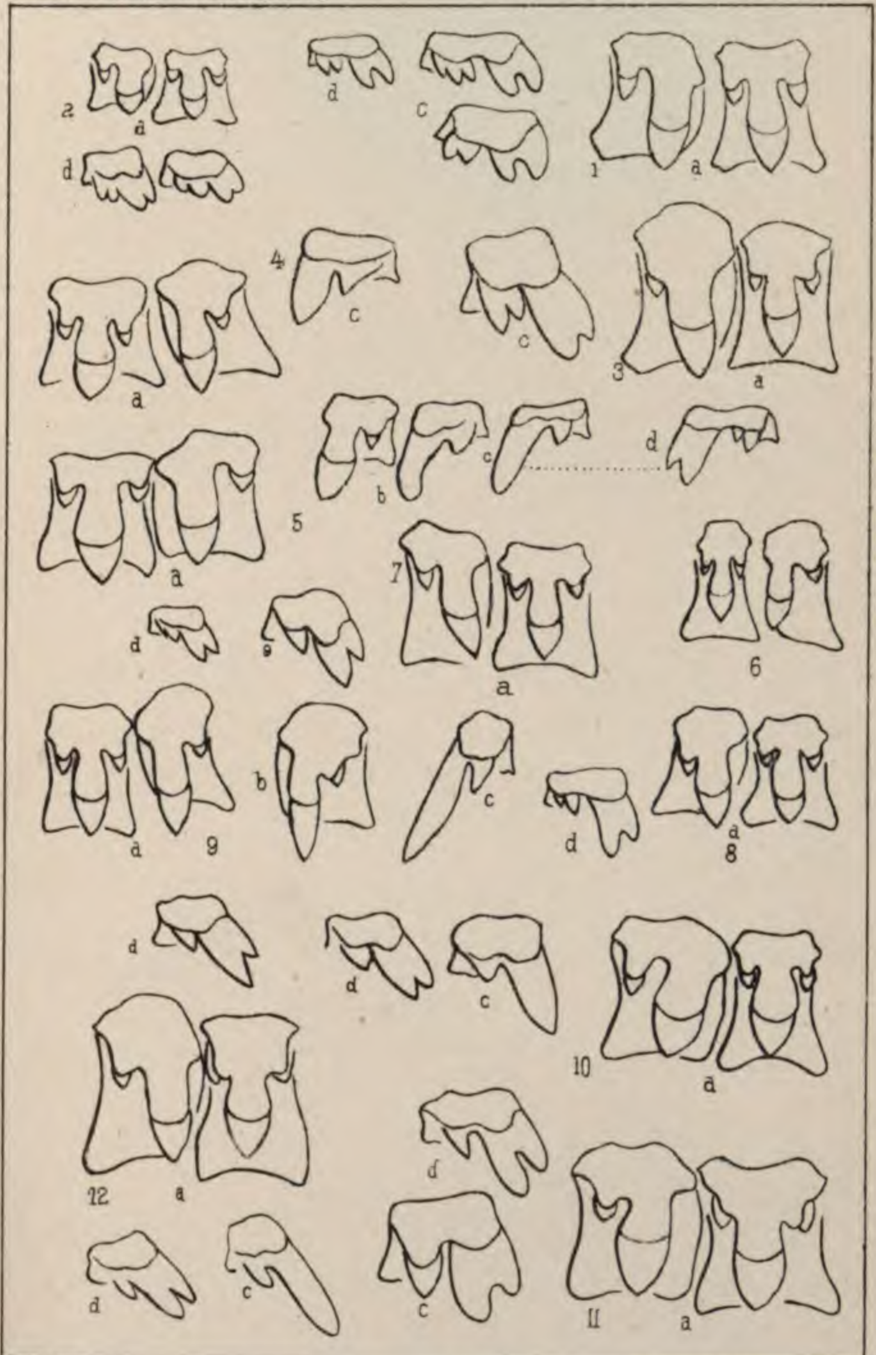
W.G.B. del.
J.H. Bufford's Sons Lith. Boston.

A Tebennophorus Carolinensis, *Bosc.* C. Pallifera dorsalis *Binn.*
B Pallifera Wetherbyi, *W.G.B.* D Orthalicus undatus, *Brug.*
E Liguus fasciatus, *Mull.*



W. G. B. del. T. Sinclair & Son, lith. Phila.

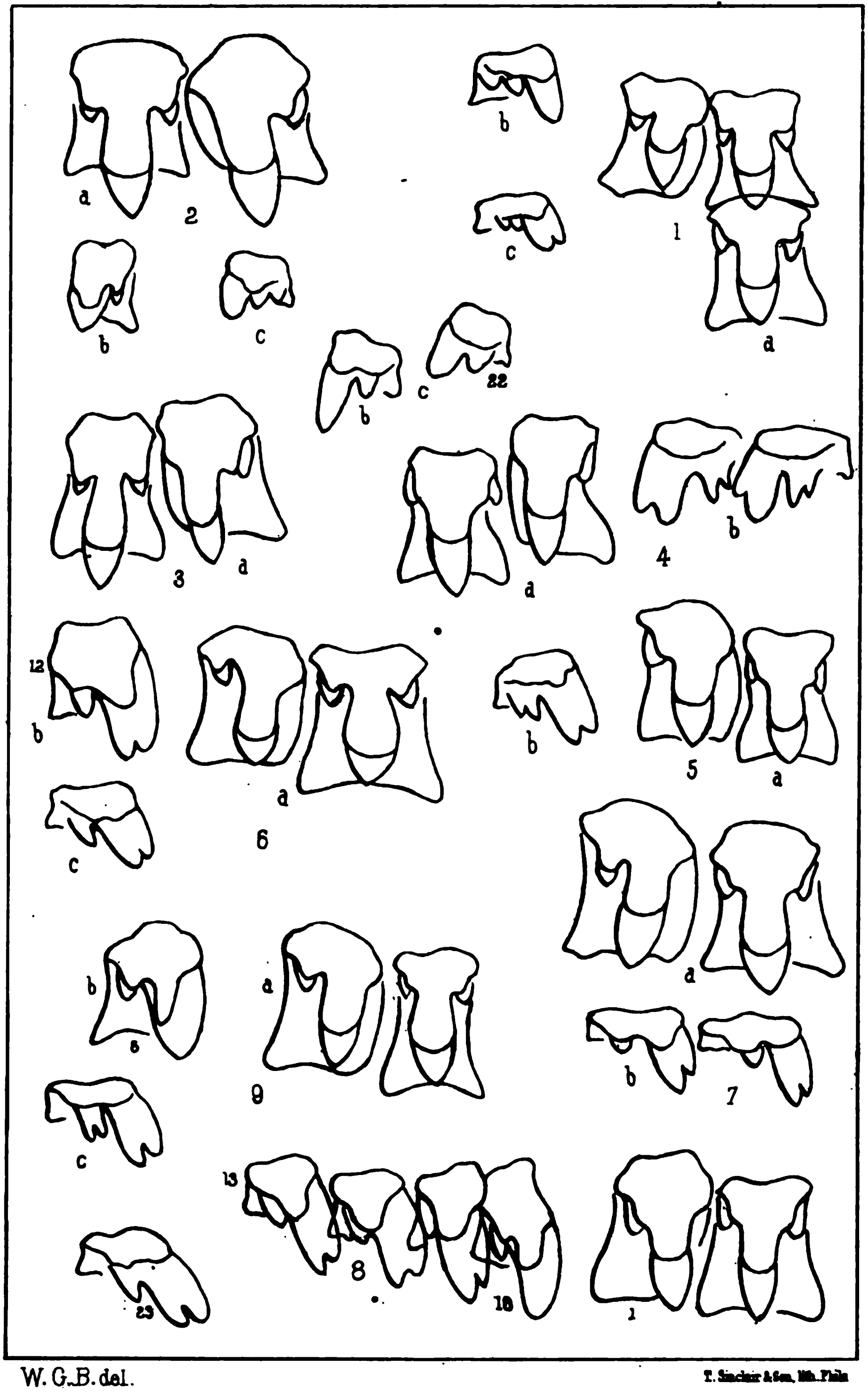
1. Patula strigosa, *Gld.* 4. Patula Idahoensis, *Newc.* 8. Patula Cumberlandiana, *Lea.*
2. Patula Cooperi, *W.G.B.* 5. Patula altemata, *Say.* 9. Patula solitaria, *Say.*
3. Patula perspectiva, *Say* 6. Patula Hemphilli, *Newc.* 10. Patula striatella, *Anth.*
7. Patula mordax, *Shuttl.*



W. G. B. del.

T. Sinclair & Son, lith. Phila.

1. Helix Texasiana, *Mor.*
2. Helix Troostiana, *Lea.*
3. Helix uvulifera, *Shuttl.*
4. Helix espiloca, *Rav.*
5. Helix Hazardi, *Bl.*
6. Helix Septemvolva, *Say.*
7. Helix Febigeri, *Bl.*
8. Helix pustula, *Fér.*
9. Helix auriformis, *Bl.*
10. Helix Mooreana, *W.G.B.*
11. Helix fastigans, *Say.*
12. Helix auriculata, *Say.*

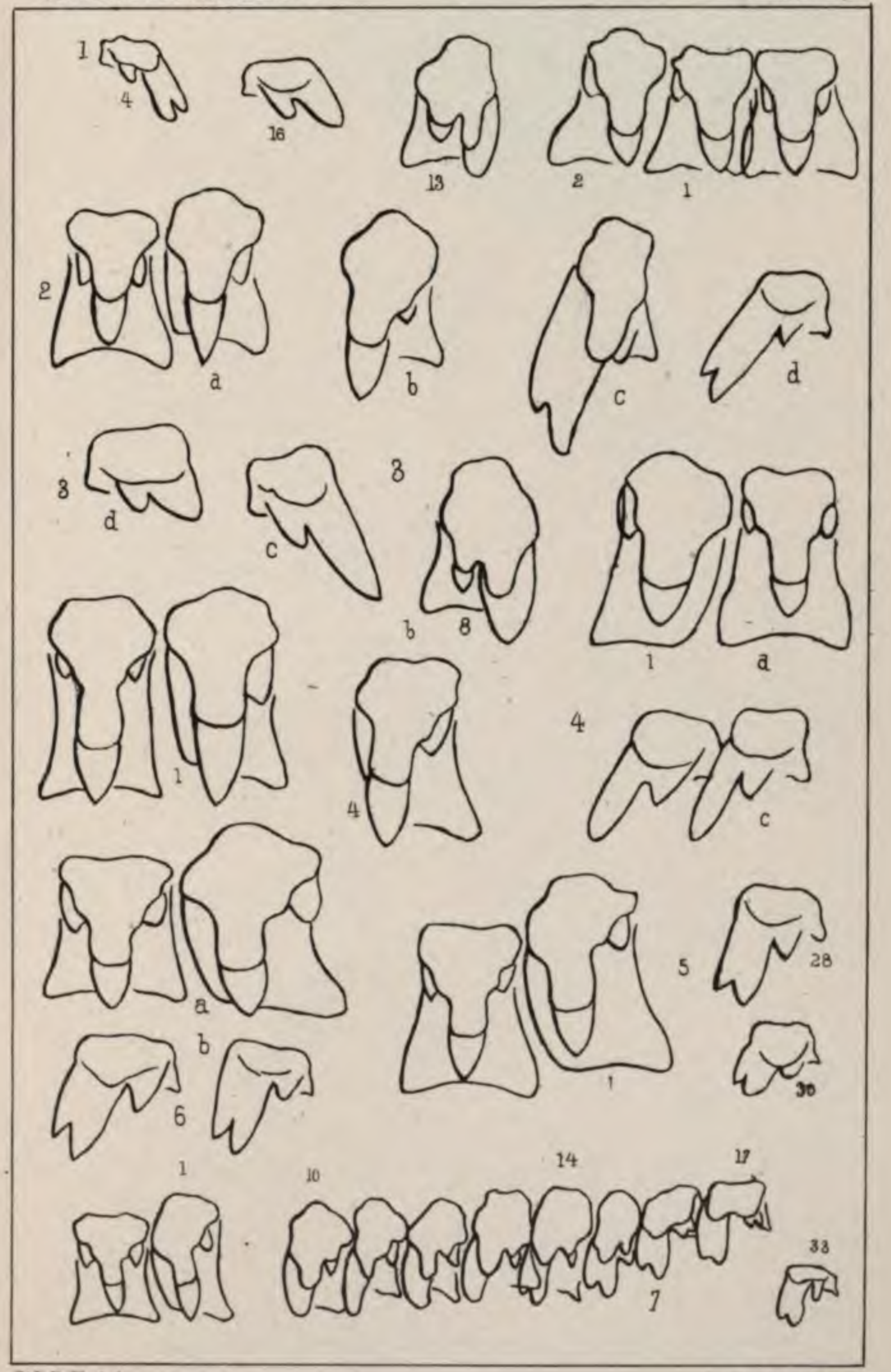


W. G. B. del.

T. Sinclair & Son, lith. Phila

1. Helix Edvardsi, *Bland*. 4. Helix monodon, *Rack*. 7. Helix stenotrema, *Fér*.
2. Helix polygyrella, *Bland*. 5. Helix germana, *Gld*. 8. Helix spinosa, *Lea*.
3. Helix Yatesi, *J.G. Coop*. 6. Helix hirsuta, *Say*. 9. Helix barbigera, *Redf*.

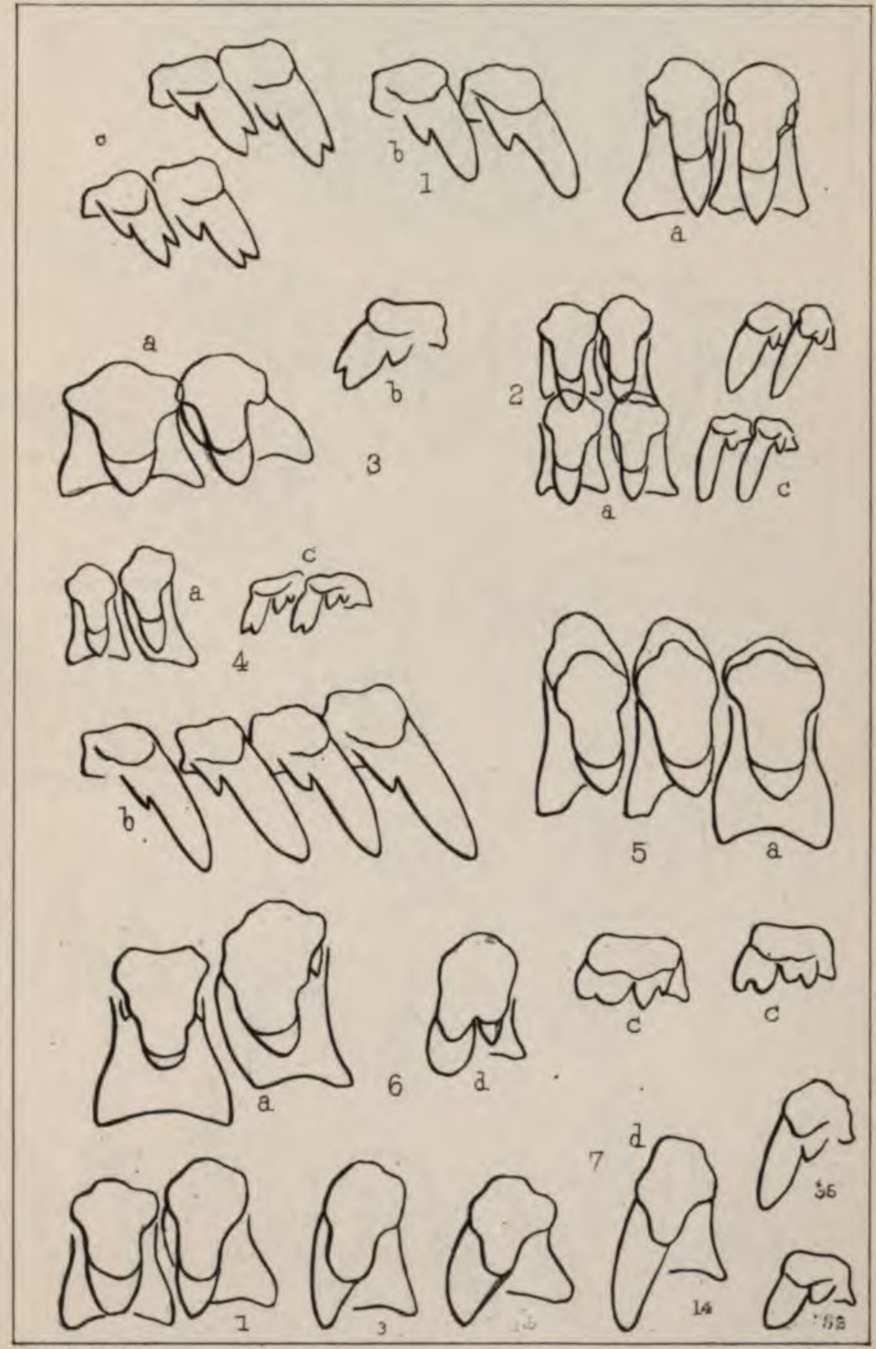
Proc. Ac. Nat. Sc. Phila. 1875. Plate X.



W. G. B. del.

T. Sinclair & Son, lith. Phila

1. Helix tridentata, *Say*. 3. Helix Rugeli, *Shuttl.* 6. Helix Hopetonensis, *Shuttl.*
2. Helix palliata, *Say*. 4. Helix inflecta, *Say*. 7. Helix appressa, *Say*.
5. Helix fallax, *Say*.

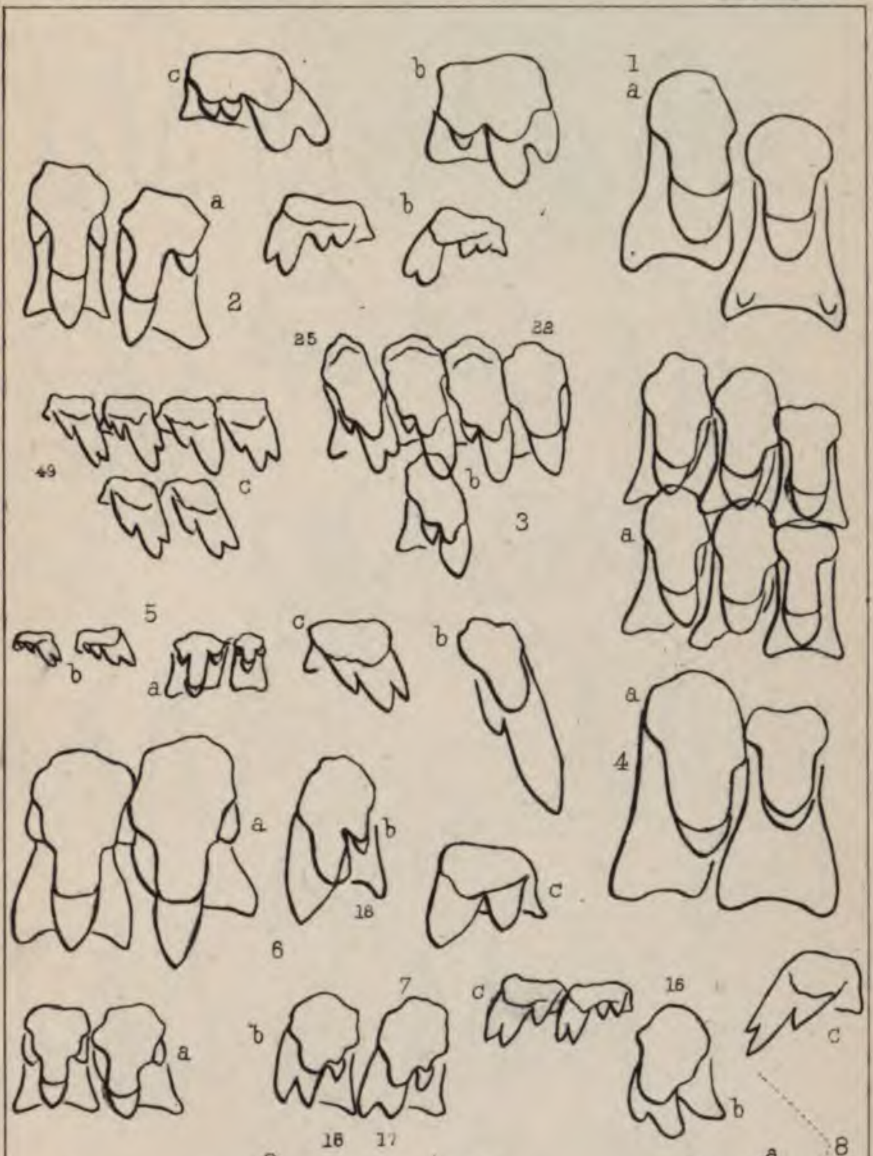


W. G. B. del.

T. Sinclair & Son, lith. Phila.

1. Helix albolabris, *Say.* 3. Helix Roemeri, *Pfr.* 6. Helix Clarki, *Lea.*
2. Helix Wetherbyi, *Bld.* 4. Helix Downieana, *Bl.* 7. Helix exoleta, *Binn.*
5. Helix Sayii, *Binn.*

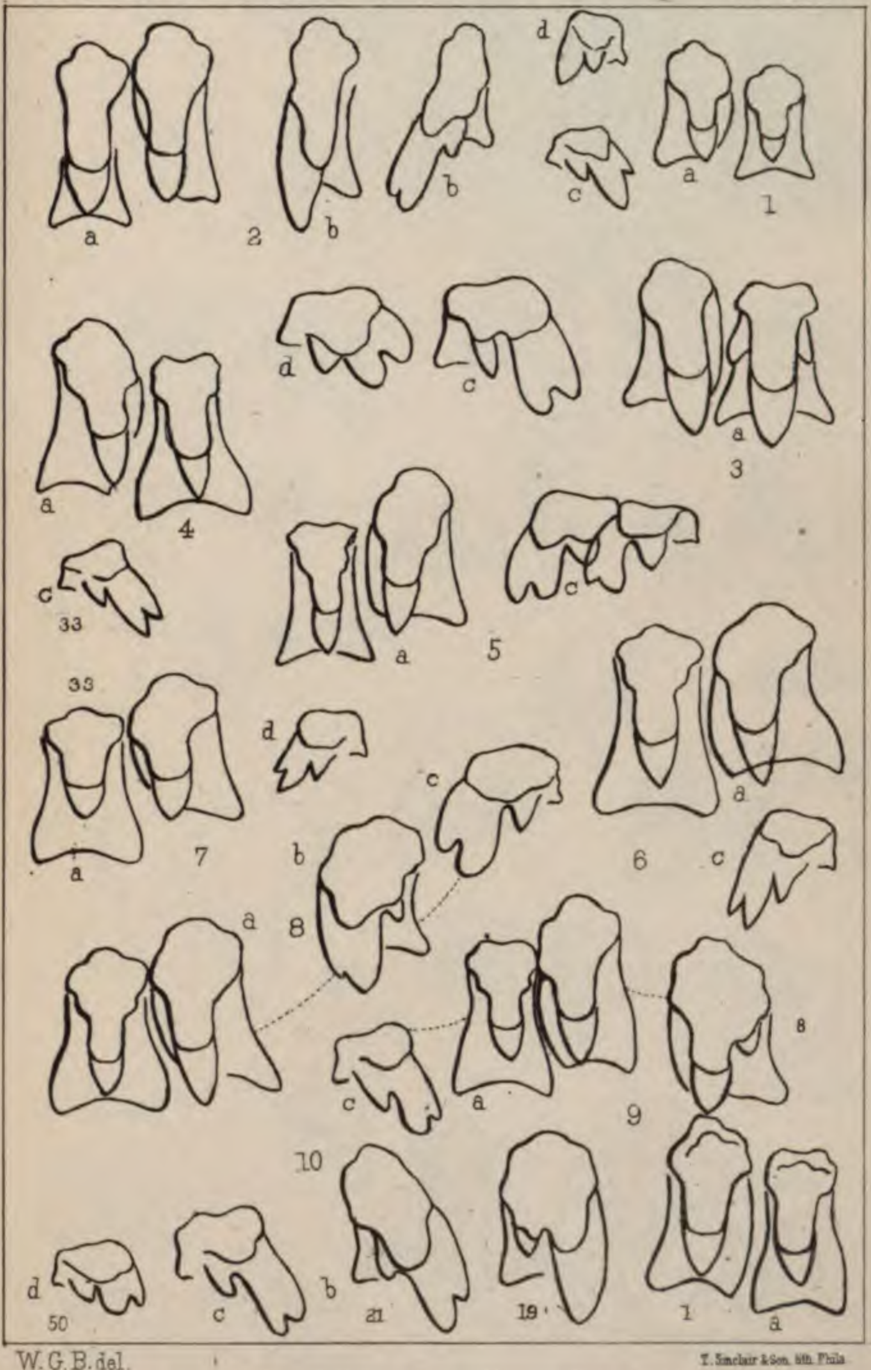
Plate XIII.



W. G. B. del.

T. Sinclair & Son, lith. Phila.

1. Hemitrochus varians, *Mke.* 5. Helix lineata, *Say.*
2. Helix griseola, *Pfr.* 6. Helix Newberryana, *W. G. Binn.*
3. Helix Stearnsiana, *Gabb.* 7. Helix aspersa, *Müll.*
4. Helix Kelletti, *Forb.* 8. Helix fidelis, *Gray.*
9. Helix infumata, *Gld.*

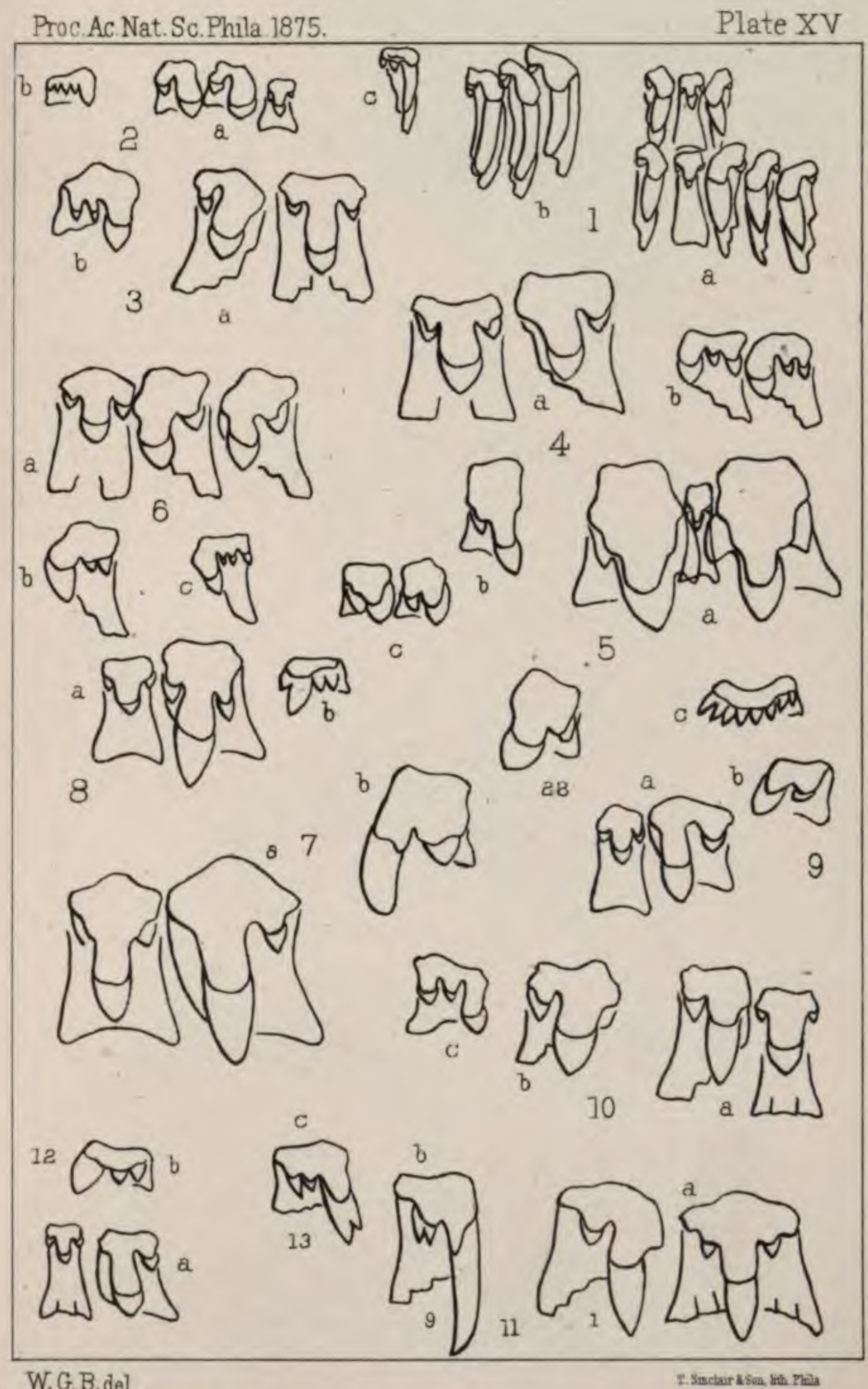


W.G.B.del.

T. Sinclair & Son. lith. Phila.

1.Helix tudiculata, *Binn.* 4. Helix Traski, *Newc.* 8. Helix Nickliniana, *Lea.*
2.Helix arrosa, *Binn.* 5. Helix sequoicola, *J.G.Coop.* 9.Helix ramentosa, *Gld.*
3.Helix ruficinta *New.* 6. Helix Ayresiana, *New.* 10.Helix exarata, *Pfr*
7. Helix redimita

Plate XV

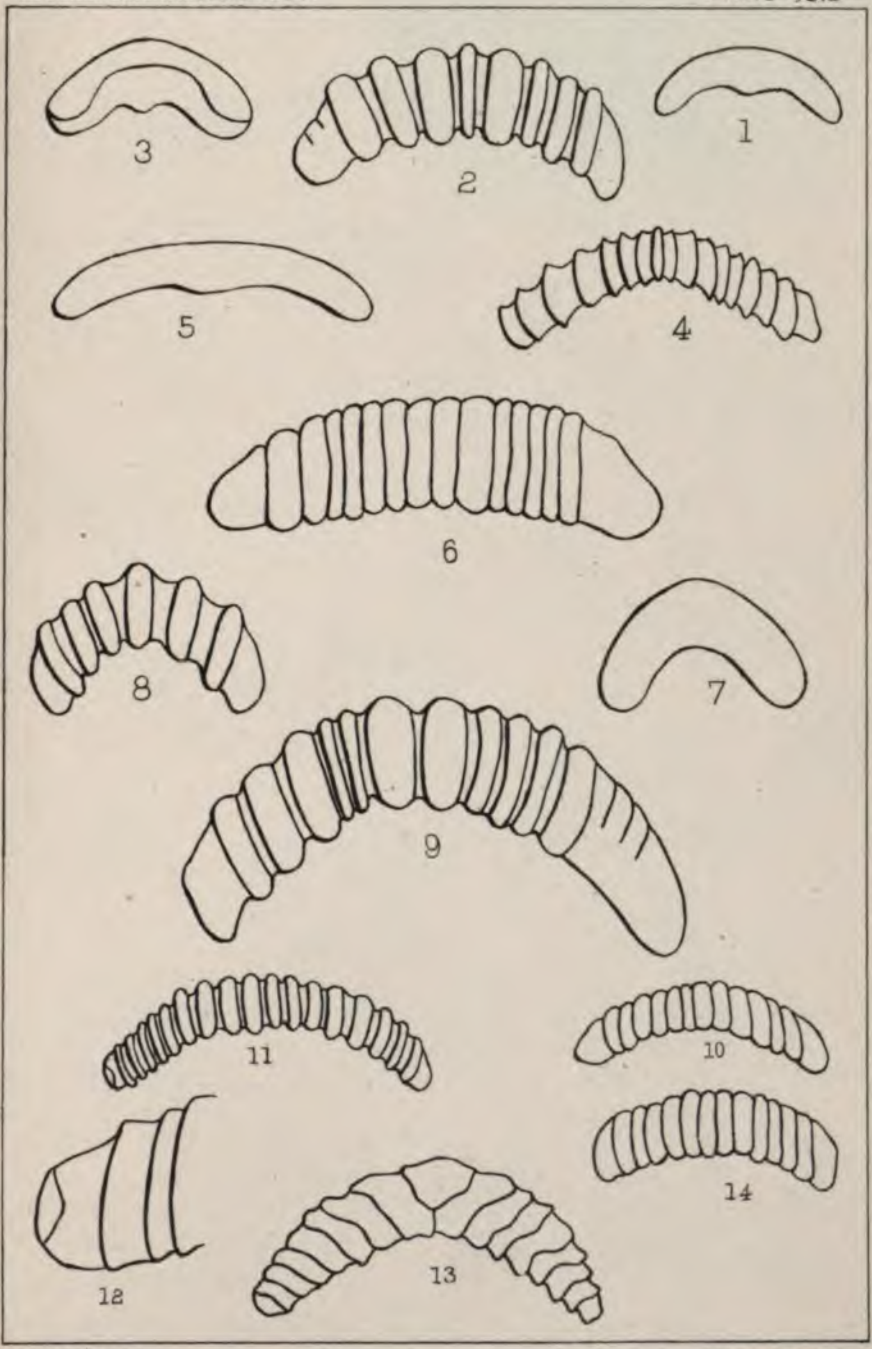


W. G. B. del.

T. Sinclair & Son, lith. Phila

1. Macroceramus Gossei, *Pf.*
2. Pupa rupicola, *Say.*
3. Succinea avara, *Say.*
4. Succinea obliqua, *Say.*
5. Stenogyra decollata, *L.*
6. Succinea effusa, *Shuttl.*
7. Bulimus dealbatus, *Say.*
8. Stenogyra subula, *Pfr.*
9. Cœcilianella subcylindrica, *Liv.*
10. Succinea campestris, *Say.*
11. Succinea lineata, *W. G. B.*
12. Pupa fallax, *Say.*

Plate XVI

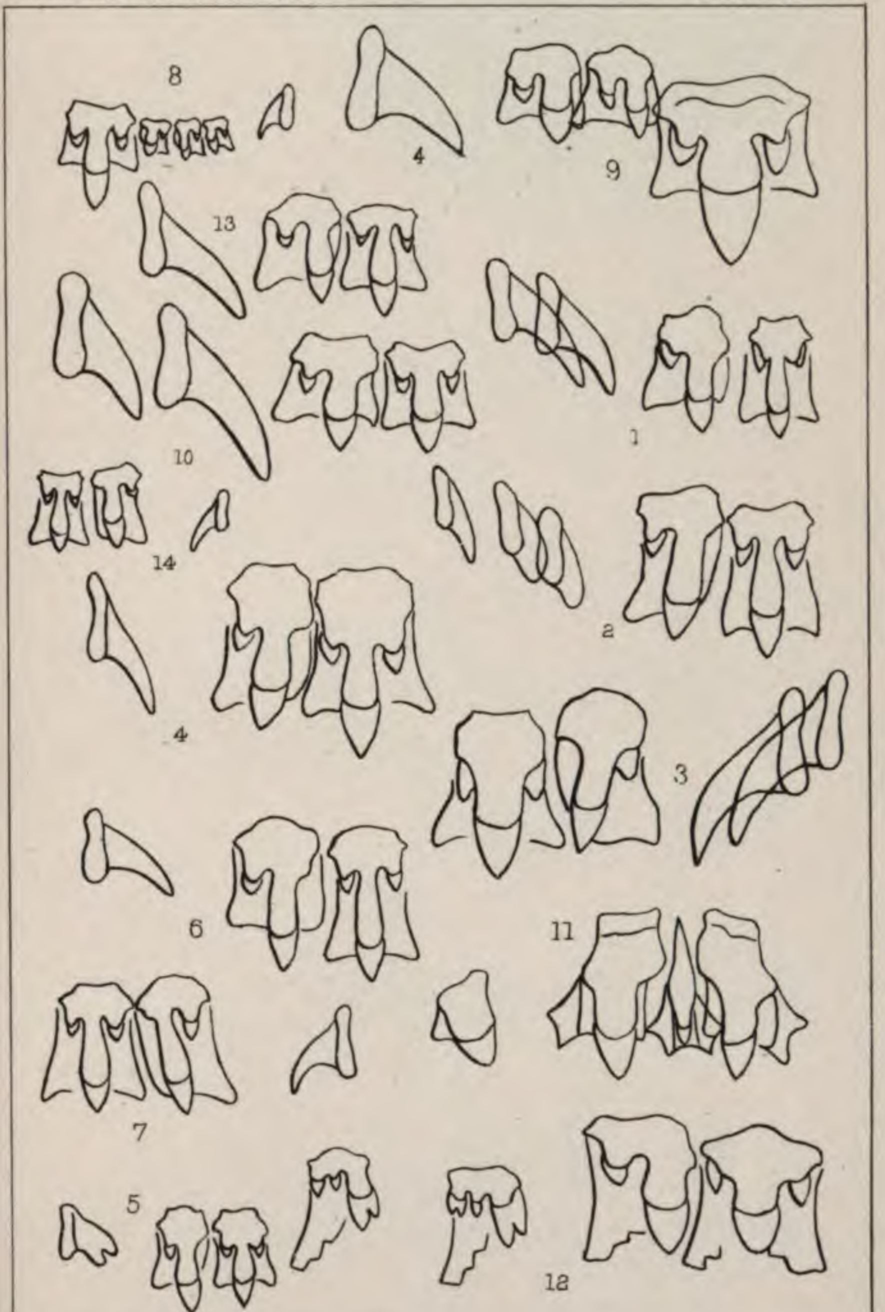


W. G. B. del.

T. Sinclair & Son, lith. Phila

1. Stenogyra subula, *Pfr.*
2. Arion hortensis, *Fer.*
3. Vitrina limpida, *Gld.*
4. Helix Newberryana, *W.G.B.*
5. *Ferussacia* subcylindrica, *C.*
6. Hemphillia glandulosa, *Bl. & Binn.*
7. Pupa rupicola, *Say.*
8. Helix aspersa, *Müll.*
9. Prophysaon Hemphilli, *Bl. & Binn.*
10. Helix Yatesi, *J.G. Coop.*
11. Helix polygyrella, *Bl. & J.G. Coop.*
12. Bulimulus sufflatus, *Gld.*
13. Orthalicus undatus, Brug.
14. Helix griseola, Pfr.

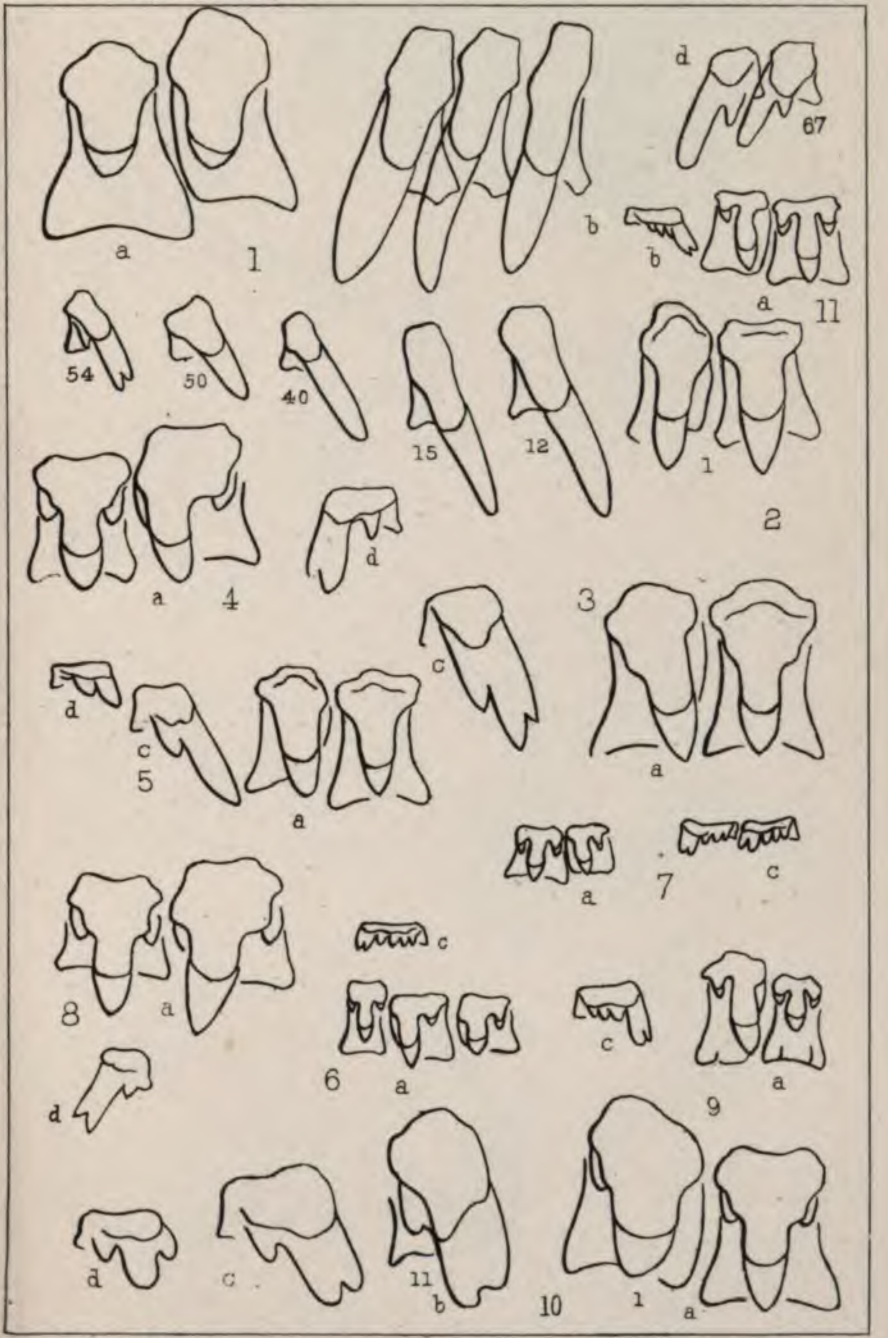
Proc. Ac. Nat. Sc. Phila. 1875. Plate XVII.



W. G. B. del

T. Sinclair & Son. lith. Phila

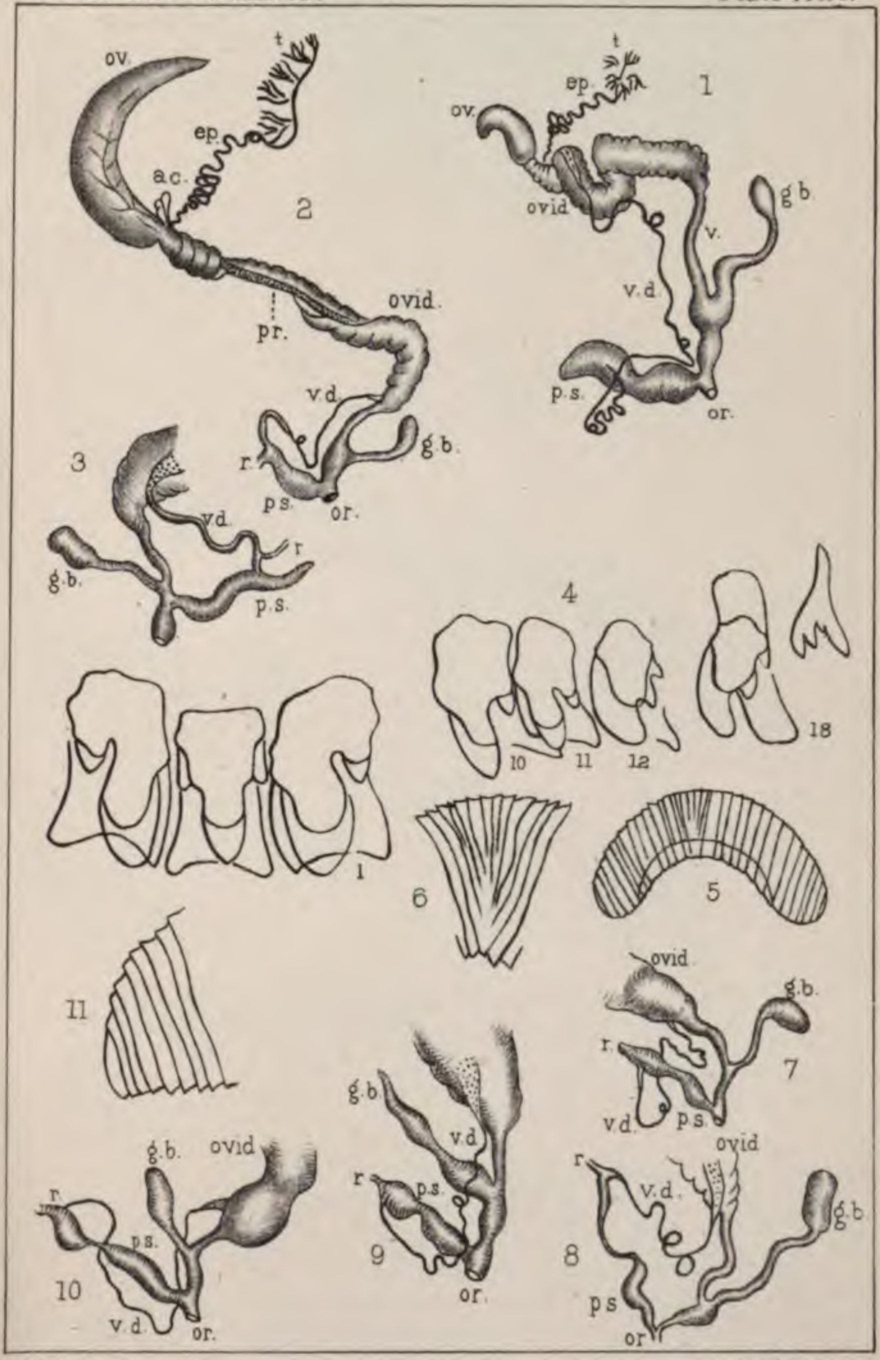
1. Zonites multidentatus, *Binn.*
2. Zonites suppressus, *Say.*
3. Zonites indentatus, *Say.*
4. Zonites arboreus, *Say.*
5. Zonites fulvus, *Drap.*
6. Zonites viridulus, *Mke.*
7. Zonites nitidus, *Müll.*
8. Zonites milium, *Morse.*
9. Zonites ferreus, *Morse.*
10. Zonites significans, *Bland.*
11. Veronicella Floridana, *Binn.*
12. Succinea Sillimani, *Bland.*
13. Zonites Binneyanus, Morse.
14. Zonites exiguus, St.



W. G. B. del.

T. Sinclair & Son lith Phila.

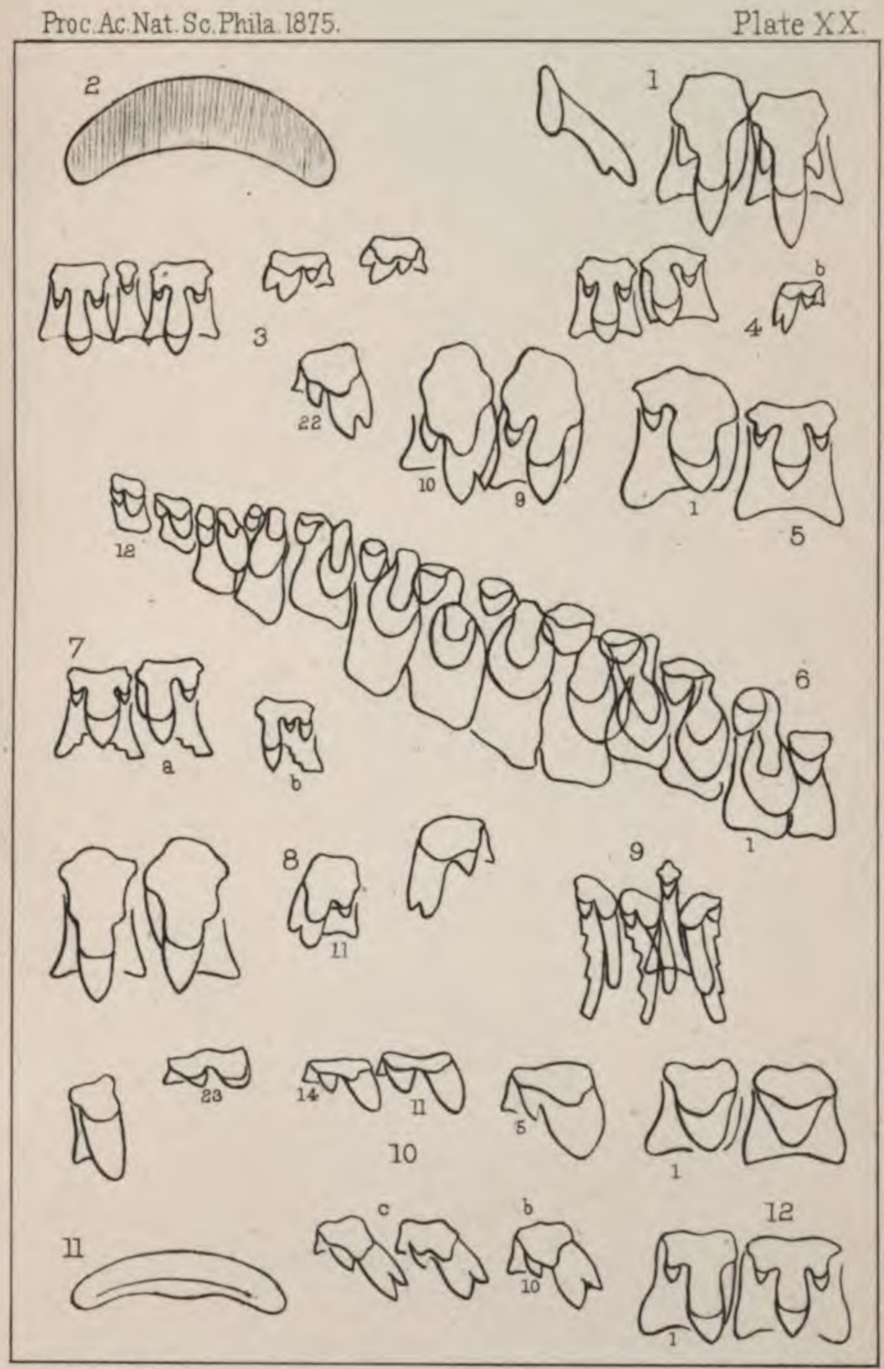
1. Helix Wheatleyi, *Bland.*
2. Helix thyroides, *Say.*
3. Helix Pennsylvanica, *Green.*
4. Helix loricata, *Gld.*
5. Helix Mitchelliana, *Lea.*
6. Helix pulchella, *Müll.*
7. Helix labyrinthica, *Say.*
8. Helix Townsendiana, *Lea.*
9. Helix asteriscus, *Morse.*
10. Helix obstricta, *Lea.*
11. Helix Hubbardi, *A.D.Br.*



W. G. B. del. T. Sinclair & Son, lith. Phila.

1. Partula.
2. H. sagemon, *Bk.*
3. H. auricoma, *Fer.*
4. P. amanda, *Pse.*
5. Partula.
6. P. gracilis, *Pse.*
7. P. umbilicata, *Pse.*
8. P. virginea, *Pse.*
9. P. fusca, *Pse.*
10. P. bilineata, *Pse.*
11. P. virginea, *Pse.*

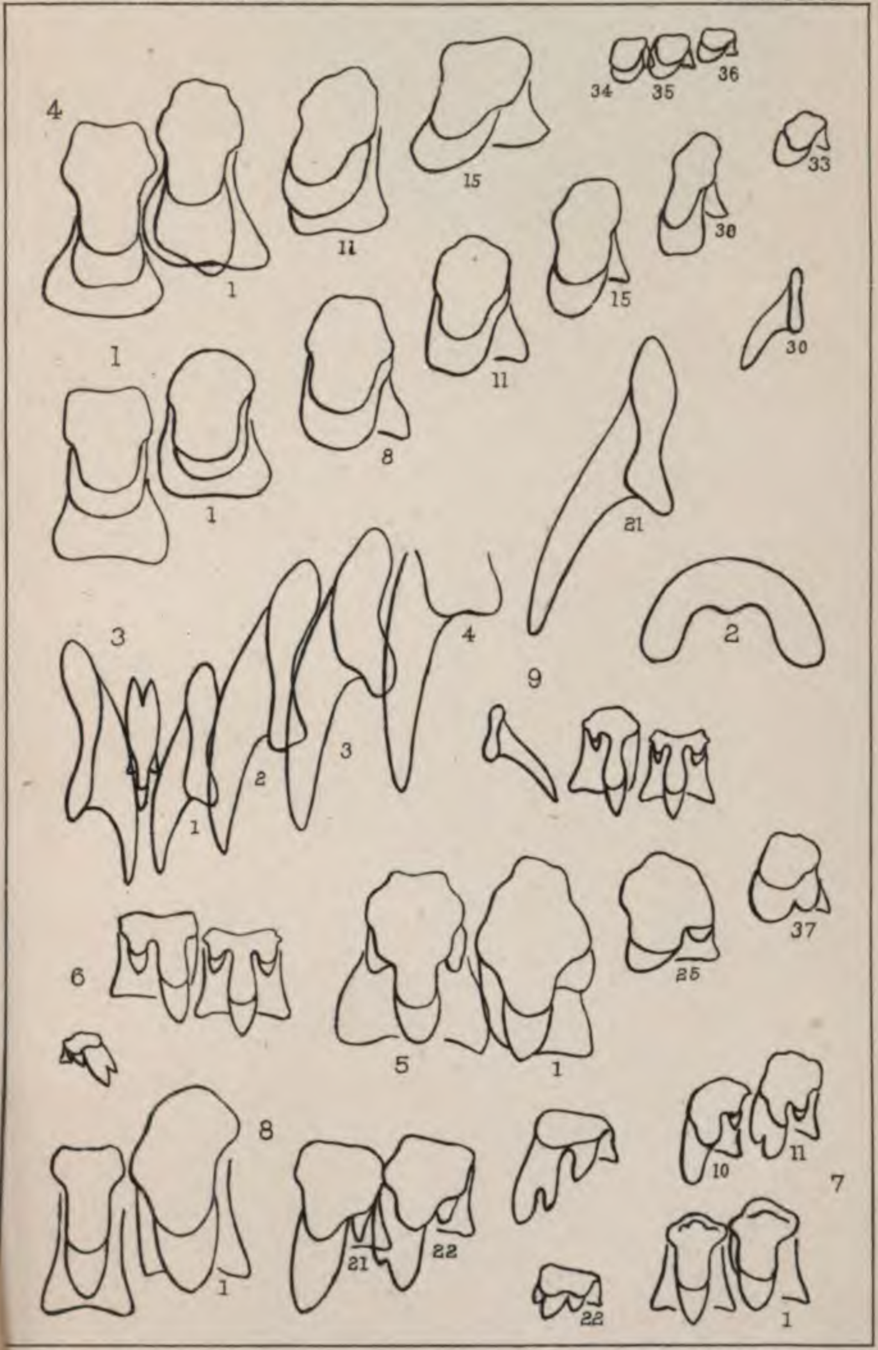
Proc. Ac. Nat. Sc. Phila. 1875. Plate XX.



W. G. B. del.

T. Sinclair & Son. lith. Phila.

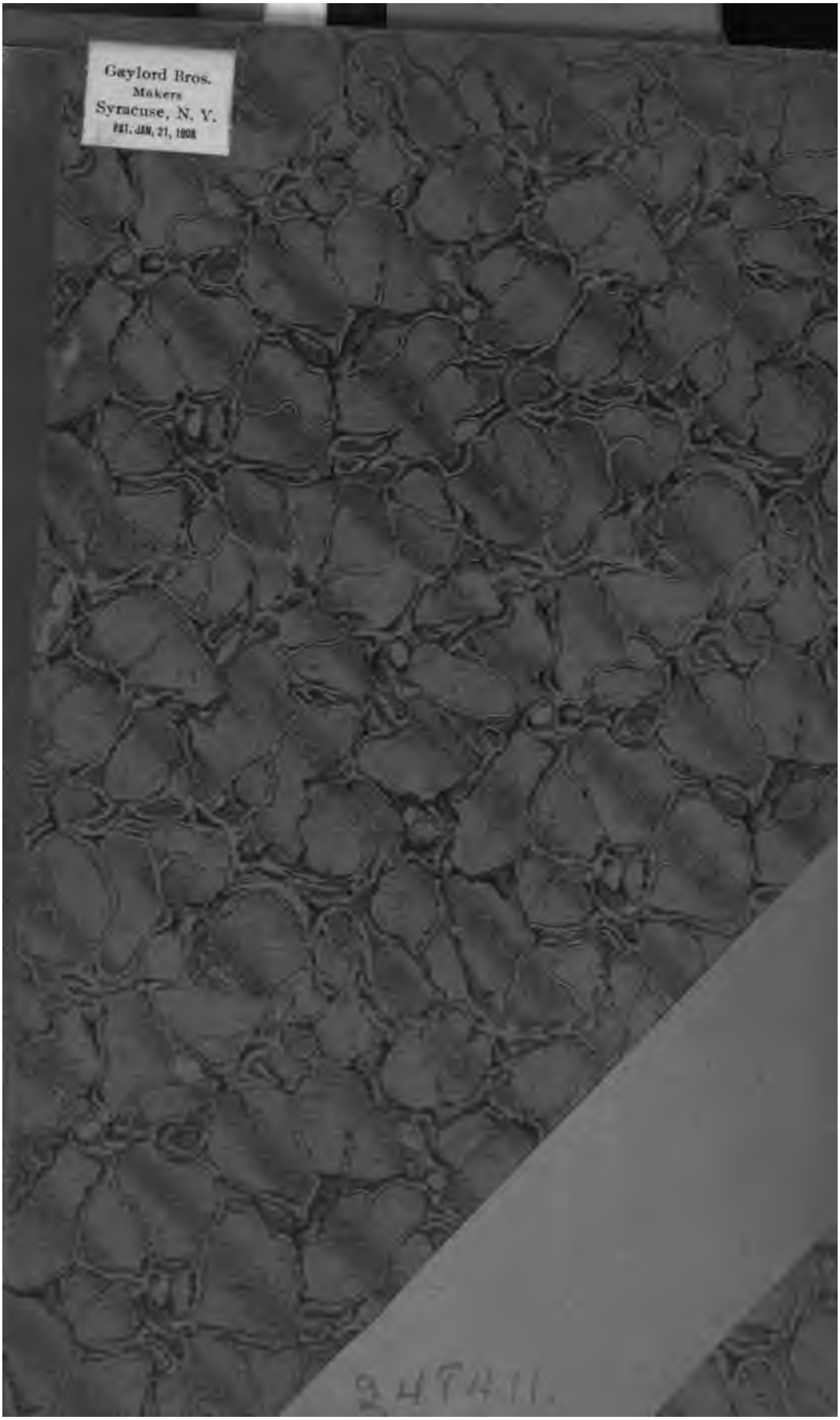
1. N. subcircula *M.*
2-3. Sten. hasta, *Pfr.*
4. Helix vortex, *Pfr.*
5. H. septemvolva, *S.*
6. C. elegans, *Pfr.*
7. S. Stretchiana, *Bl.*
8. H. pyrozona, *Pl.*
9. Macr. turricula, *Pfr.*
10. H. Goldfussi, *Mke.*
11 12. H. astur, *Sb.*



W. G. B. del. T. Sinclair & Son lith. Phila.

1-2. H. Arangiana, *Py.* 5. H. auricoma, *Fer.* 8. H. Sieboldtiana *Pfr.*
3. Macroc euspira, *Pfr.* 6. End. tumuloides, *Garr.* 9. Z. minusculus, *Binn.*
4. H. sagemon, *Blc.* 7. H. convicta, *Cox.*

Gaylord Bros.
Makers
Syracuse, N. Y.
PAT. JAN. 21, 1908



Gaylord Bros.
Makers
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PAT. JAN. 21, 1908

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Notes on American land shells. v.2, pt.2

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Vol. 2 pt. 2

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NOTES

ON

AMERICAN LAND SHELLS

AND OTHER

MISCELLANEOUS CONCHOLOGICAL CONTRIBUTIONS.

VOL. II. PART II.

BY

W. G. BINNEY.

BURLINGTON, N. J.
PRINTED FOR THE AUTHOR
JULY, 1874.

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ON THE

GENITALIA AND LINGUAL DENTITION OF PULMONATA.

BY

W. G. BINNEY.

[Reprinted from Annals of the Lyceum of Natural History, N. Y., Vol. xi, June, 1874.]

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IV.—*On the Genitalia and Lingual Dentition of Pulmonata.*

BY W. G. BINNEY.

With Plates I-VI.

Read May 25th, 1874.

It will be noticed that in the following descriptions of the genital system, I have followed Dr. Leidy (Terr. Moll. U. S., I) in applying the terms *ovary* and *oviduct*. I am aware of other names being applied to the organs by other authors.

I take this opportunity of strongly urging upon conchologists the study of the genital system as a most reliable specific character, in the terrestrial Pulmonata.

For the species extralimital to the United States, I am indebted to my friend, Mr. Thomas Bland, as well as for their identification. The most interesting of them were collected by Prof. Orton, in his late journey in northern Peru.

Limax flavus, Linn.

A few days since a colony of this species was discovered by a friend in the cellar of his house in Burlington, N. J.

The specimens agree perfectly with the description and ures in the "Terrestrial Mollusks of the United Stat The genital system is also the same as figured by Leid the same work, and by Moquin-Tandon (Moll. Terr. et F de France). There can be no doubt, therefore, of the i tity of the species.

The figure of the dentition of this species given by m L. and F. W. Shells N. A., I, p. 63, f. 105, is drawn f some other species.

The true *L. flavus* now examined by me has central teeth with subc lete side cusps, bearing no cutting points, central cusp short, wi short, bluntly pointed cutting point. Laterals like the centrals, bu symmetrical. Marginals aculeate, the extreme ones bifurcated. T in the lingual examined over 60–1–60.

The figure by Dr. Leidy published by Mr. Bland myself (Ann. Lyc. Nat. Hist. of N. Y., IX, 285) th unsatisfactory, was, no doubt, drawn from this species.

The lingual membrane examined by me agrees with figures given by Heynemann* of the dentition of *L. fla*

Limax agrestis, Linn.

Specimens from Burlington, N. J., of this species, of doubted identity, agreeing externally and anatomically the figures in the "Terrestrial Mollusks of the United Stat furnished the lingual membrane here described.

Teeth 50–1–50, with 14 perfect laterals. Centrals long, narrow, w middle long cusp, extending to the lower edge of base of attachment bearing a long, acute cutting point, extending far below the l edge; side cusps subobsolete, but bearing well-developed, trian cutting points. Laterals like centrals, but unsymmetrical by the cha form of the inner cutting point. Marginal teeth aculeate, the ext ones do not appear to be bifurcate.

Jaw wide, low, slightly arcuate, with broad median projection.

---

* See Mal. Blatt, X.

Limax Hewstoni, I. G. Cooper.

The specimens examined are from the state collection of California, presented by Dr. J. G. Cooper.

These specimens are not in good condition for anatomical examination, but I am able to state that both testicle and ovary are large. The oviduct is long and greatly convoluted. The prostate is well developed. The vagina is very short, the very short duct of the genital bladder enters at about its middle. The last named organ is large, globular. The penis is small, short, cylindrical, expanded and bulbous at its apex, where the vas deferens enters. I could detect no accessory organs in the single specimen imperfectly examined.

The genitalia are somewhat of the same type as those of *L. flavus* (see Terr. Moll. U. S., I), Linn., but the dentition of the latter is quite distinct (see above). There is a still stronger resemblance to the genitalia of *Amalia gagates* as figured by Semper (Phil. Archip., pl. xi, fig. 9), so far as the penis and genital bladder are concerned.

The species certainly belongs to the section *Amalia*, as understood by Semper (l. c. p. 84) and Heynemann (Mal. Blatt., X, 200) as shown by the dentition of the lingual membrane. I have already, in connection with Mr. Bland (Ann. N. Y. Lyc. N. H., X, 349), described the dentition. It is necessary, however, to be more explicit in the description, as several types are found in the genus *Limax* (in the broad sense usually adopted).

Dr. Cooper's type now before me has the lingual membrane long and narrow. There are about 50-1-50 teeth. The centrals are tricuspid, the middle cusp is stout and reaches to the lower edge of the base of attachment, the side cusps are not well developed; all three cusps bear a cutting point. The base of attachment is almost as broad as high. The lateral teeth, about 22 or 25 in number, are of the same type as the centrals, equally tricuspid, and so symmetrical as to be with great difficulty distinguished from the central tooth, excepting the outer ones, which lose the inner cusp. The marginal teeth are aculeate, not bifid, and are generally short and stout, but in some specimens are long and slender.

So far as outward appearance goes, the species somewhat resembles *Amalia marginata*, Drap., as figured by Lehmann (Lebenden Schnecken, etc., pl. v, fig. B). It is, however, by no means certain that it was introduced into San Francisco, as Mr. H. Hemphill has sent me specimens of an

Amalia from Los Angeles. His species had about 48 teeth in each row, 16 being laterals, the balance marginals, a difference of arrangement which may fairly be considered to show a specific difference between his specimens and the San Francisco form, though his discovery leads us to consider *Amalia* as native to California.

Limax maximus, Linn.

I have also reëxamined the lingual of this species from specimens collected in Newport, R, I. (see my edition of Gould's Invertebrata of Mass., p. 407, fig. 669) and find it to agree with the descriptions and figures of Lehmann and Heynemann. I am preparing an exhaustive paper on the dentition of our land shells, in which more particular descriptions of the dentition of all our species will be given. I will here say, however, that in the specimen examined by me the bifurcation of the marginals commences nearer the median line than is described by Heynemann. There are but twelve marginals without bifurcation in my specimen, that is, the bifurcation commences at about the thirtieth tooth from the central line. Heynemann gives the commencement of the bifurcation at the sixty-fifth tooth. There are 76–1–76 teeth.

Limax campestris, Binney.

To complete the series of North American *Limaces*, I subjoin a summary of the characters of this species, the only one now known to be native to eastern North America. There are 36–1–36 teeth, 11 being perfect laterals, and 25 being marginals. Of the latter about one-half are bifid. The centrals and laterals are of the same type as in *L. agrestis*.

Judging from dentition alone, *L. maximus* and *flavus* would be placed in *Heynemannia*, a subgenus of *Limax; agrestis* in s. g. *Agriolimax; campestris* in s. g. *Malacolimax;* while *Hewstoni* would be in the genus *Amalia*. (See Heynemann, Nachr. Mal. Gesell., II, 163.)

Limax Weinlandi, Heynemann (Mall. Blatt., X, 212), I do not know. The figure given by Heynemann (l. c. pl. ii, fig. 1) of its dentition does not agree with that of *L. campestris*.

Limax campestris differs widely in its genitalia from *Limax agrestis*, as will be seen by Leidy's figures in Terr. Moll. U. S., I, pl. ii, figs. 6, 8.

Zonites capnodes,* W. G. Binney.

Tennessee.

Jaw as usual in the genus.

Lingual membrane broad, with numerous rows of about 66–1–66 teeth. Centrals long, with a long, slender, median cusp, reaching the base of attachment and bearing a long, slender point projecting beyond it. Side cusps subobsolete, but represented by the cutting points, which are greatly developed, triangular, stretching beyond the sides of the base of attachment. Lateral teeth of same type as centrals, but bicuspid; there are about nine perfect laterals. Marginals aculeate, as usual in the genus.

I have not been able to observe the complete genital system of the species. The penis has the same arrangement as in *Z. lævigatus*. The external orifice is quite under the edge of the mantle.

In the Land Mollusken of the "Archip. der Philippinen" (p. 78, pl. iii, fig. 27; pl. v, fig. 21), Semper describes and figures the genital system, jaw and lingual dentition, which he refers to *Z. lucubratus*, Say. The specimen examined by him was from Tennessee. It is difficult to decide from what species Semper drew his description. It certainly was not the true *lucubratus*, which is a Mexican species. A comparison of my descriptions and figures of *lævigatus*, *inornatus*, *fuliginosus* and *friabilis* shows that neither of those species could have been before Semper. His description of the lingual membrane would better apply to *capnodes*. I have not been able to examine the whole of the genital system to see how nearly that also agrees with his figures.

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* Formerly erroneously spelt *Kapnodes*.

Zonites friabilis, W. G. Binney.

Mr. A. G. Wetherby.

Jaw as usual in the genus.

Lingual membrane similar to that above described of
Teeth about 57-1-57, with six perfect laterals.

The genital system is figured on pl. V, fig. II. The ovary
light-brown, and blunt. The oviduct (8) is short. The v
and narrow, with a yellow prepuce-like expansion at the en
duct of the genital bladder, which is near the base. The ge
(9) is large, oval, on a duct of about equal length and size
The penis sac (5) is long and slender, and peculiarly chara
lateral bulbous expansion near its base, bearing the retracto
Beyond this bulb the sac is narrow, but gradually expands, a
end again very gradually tapers towards the apex, where the
(7) enters. Its orifice is side by side with that of the vagin

I found no dart in the bulb-like organ attached to the pe
ably is a form of prostate. The external orifice is under the

Zonites inornatus, Say.

The genitalia (pl. V, fig. I) have the same general arran
Z. friabilis, herewith described. The ovary (11), however,
more developed, being in this species the most conspicuou
system; the epididymis (2) is less convoluted, the oviduct
the vagina shorter, the genital bladder (9) more clavate,
duct (16), and there is a small globular vaginal prostate (18

Zonites sculptilis, Bland.

Tennessee. Miss Annie E. Law.

Jaw as usual in the genus.

Lingual membrane long and narrow. Teeth about 40-1-
perfect laterals. Centrals tricuspid, laterals bicuspid, the
each being almost obsolete, but surmounted by a triangula
Marginals aculeate. The dentition is of the same type as i
see above. (Pl. II, fig. IV.) Fig. *b* represents the two ext
teeth.

Zonites Elliotti, Redfield.

Hayesville, N. C. Miss Annie E. Law.

Lingual membrane as usual in the genus. It will be noti
are not any well developed side cusps to the centrals and la
there are well developed cutting points. Teeth about 32-
perfect laterals.

The character of the dentition, as well as the caudal mucus pore, proves the species to be a true *Zonites*, and not a *Macrocyclis*, in which genus it is placed by Tryon, Am. Journ. Conch., II, 246.

The existence of the dart sac and dart has already been published.

Zonites internus, Say.

An examination of the animal by Mr. Bland shows the existence of a dart.

Helix rufo-apicata, Poey. (*Hemitrochus.*)*

Cuba. Mr. Arango.

Jaw slightly arcuate, ends but little attenuated, blunt; anterior surface without ribs; cutting edge with a broad, blunt, median projection.

Lingual membrane (pl. V, fig. v) long and narrow. Centrals long and narrow with one median stout cusp, bearing a short, bluntly pointed cutting point, the side cusps subobsolete. Laterals like the centrals, but unsymmetrical. Marginals subquadrate, with one very broad, oblique, acutely trifid cutting point, the central division the largest.

The figure *a* gives one central tooth with two adjacent laterals, *b* gives two extreme marginals.

The dentition has the same general character as the other species of *Hemitrochus*, examined by me, viz., *gallopavonis*, *graminicola*, *varians* and *Troscheli*.

Helix badia, Fér. (*Dentellaria.*)

Martinique.

For jaw and dentition see Proc. Ac. Nat. Sc., Phila., 1874, p. 52.

Genital system resembling that of *H. Josephinæ*, herewith described.

Helix nuxdenticulata, Chemn. (*Dentellaria.*)

Martinique.

For description of jaw and lingual dentition see Proc. Ac. Nat. Sc. Phila., 1874, p. 52.

The genital system is figured on pl. V, fig. viii. The ovary (11) is short, stout. The oviduct (8) is wide, sac-like. The vagina is short, small, with a bulbous expansion near its top; the duct of the genital bladder enters, at about the middle of its length, the sac of the penis near its base. The penis sac (5) is very prominent. It is as long as the

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*Mr. Bland and I have elsewhere (Ann. of Lyc. of Nat. Hist. of N. Y., X, 341) pointed out the great difference in the lingual dentition of *Helix muscarum*, Lea, the type of the subgenus *Polymita*, and the other species referred to the subgenus by von Martens. We have suggested using for the latter the name *Hemitrochus*. We have also shown that *H. picta* belongs to the true *Polymita*, sharing the peculiar dentition of *muscarum*.

oviduct, narrowed at its base, along the remainder of its course q stout, but with a subcentral contraction, and a blunt apex, where the tractor muscle (6) is attached, and where the vas deferens (7) enters, latter swollen at this point. The genital bladder (9) is small, oval; duct (16) is long, irregular, narrowed above and below, but very m swollen along the middle three-fifths of its length. As with the penis, duct of the genital bladder forms a conspicuous feature of the system.

Helix nucleola, Rang. (*Dentellaria.*)

Martinique.

Lingual membrane and jaw already described by me (Proc. Ac. N Sc., Phila., 1874, p. 52).

Genital system figured on pl. II, fig. vi. The ovary (11) is long a narrow. The oviduct (8) is long, rather stout, but little convolut The vagina is narrow, about one-third the length of the oviduct; ju below the middle of its length it has a bulbous expansion, which receiv the long, slender duct (16) of the small, oval genital bladder (9). Tl penis sac (5) enters the vagina near its base; it is very long, cylindric slender, with the vas deferens (7) and retractor muscle entering at i apex.

Helix Josephinæ, Fér. (*Dentellaria.*)

Guadeloupe.

For description of jaw and lingual membrane, see Ann. Lyc. N. H. N. Y., X, 306.

Genital system figured on pl. V, fig. ix. The testicle (1) is compose of white cæca tipped with brown. The epididymis is greatly convolute near the ovary. The latter organ (11) is broad. The oviduct (8) is lon The vagina is long and narrow; it receives the long slender duct (16) c the small globose genital bladder (9) near its top. The penis sac (5) i long and slender, its opening being by the side of that of the vagin rather than actually into the latter organ, its apex rapidly narrowing t an acute point, near which enters the vas deferens (7).

Helix discolor, Fér. (*Thelidomus.*)

Martinique.

Jaw and lingual membrane already described by me (Proc. Ac. Nat Sc. Phila., 1874, p. 51).

Genital system short and stout in its various parts, excepting the ovar (11) which is long, slender, acutely pointed. The epididymis (2) is long convoluted at the end near the oviduct. The oviduct (8) is stout, sac-like The genital bladder (9) is as long as the oviduct, clavate, stout, with n distinct duct, but gradually tapering to its entrance into the vagina which is at the upper end of the latter. The penis sac (5) is the mos prominent organ. It enters the vagina at its base. It is as long as the whole system, stout, especially in its lower half, abruptly terminating in an acute point above, where it receives the vas deferens. The latter organ (7) is enlarged for some distance after leaving the penis sac. The retractor muscle (6) of the penis is inserted on the side of the sac, at the lower third of its length. Pl. II, fig. IX.

Helix Troostiana, Lea. (*Polygyra.*)

Kentucky, Mr. A. G. Wetherby.

Jaw as usual in the sub-genus *Polygyra*, with about ten, broad, crowded ribs, denticulating either margin.

Lingual membrane (pl. V, fig. VI) long and narrow. Teeth about 25–1–25. Centrals and laterals quadrate, the former tricuspid, the latter bicuspid, the cusps stout: all the cusps with cutting points. Marginals low, wide, with one inner, oblique, stout, short, bluntly bifid cusp, and one outer, shorter, bluntly bifid cusp.

Genital system (pl. V, fig. III) long and slender, especially the ovary (11), and oviduct (8); vagina long, receiving the duct of the genital bladder below its middle, and the sac of the penis still lower down; penis long, tubular, of about same width as the vagina, with a prominent bulb at its apex, into the end of which is inserted the vas deferens (7) and at the side of which the retractor muscle (6) is attached; genital bladder (9) moderate, oval, on a duct (16) of about equal length and size as the vagina.

Helix obstricta, Say. (*Triodopsis.*)

Ohio, Mr. A. G. Wetherby.

The genital system resembles exactly that of *H. palliata*, Say, as figured by Dr. Leidy in Terr. Moll. U. S., I, pl. vii, fig. 8.

Helix Clarki, Lea. (*Triodopsis? Mesodon?*)

Hayesville, N. C., Miss Annie E. Law.

Jaw as usual, arcuate, ends attenuated, blunt; anterior surface with about fourteen stout, separated ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth about 35–1–35. Centrals with a stout, short, median cusp, bearing a very short, blunt, cutting point, the outer cusps subobsolete. Laterals like the centrals, but unsymmetrical. Marginals wide, low, with one, inner, short, broad, sharply bifurcated cutting point, and one shorter, outer, bifurcated cutting point. Pl. VI, fig. I.

The genital system (pl. VI, fig. VI) is peculiar in several respects. The ovary (11) is very slender, and equals about one-half the length of the oviduct. The epididymis (2) is highly developed, greatly convoluted, stout, four times the length of the ovary. The oviduct (8) is convoluted.

The prostate (4) is greatly developed. The penis sac (5) is short, c drical, entering the vagina near its base, and receiving both vas defe (7) and retractor muscle (6) at its apex. The genital bladder (small, oval, with a short duct (16) entering the vagina about the mi of its length. The vas deferens (7) is swollen on leaving the pros Testicle not observed.

The marginal teeth of the lingual membrane are more of the ty *Triodopsis* than *Mesodon*, as known to us at present. I am in do therefore, of the subgeneric position of the species.

Helix Wheatleyi, Bland. (*Mesodon.*)

Hayesville, N. C., Miss Annie E. Law.

Jaw as usual in the subgenus, with about twelve ribs.

Lingual membrane long. Teeth about 67-1-67. Centrals and late as described under *H. Clarki.* Marginals high, narrow, with one long cutting point to the single cusp. Outer marginals about as hig wide, with one long inner, obtusely pointed, cutting point, and shorter, outer cutting point.

The first marginal teeth resemble those of *H. thyroides* in the sin greatly produced cutting point. The extreme marginals, however, bifid.

The genital system in the specimens received was too decayed to al of complete examination. The penis, however, was in perfect conditi It forms the peculiar feature of the system on account of its enorm development. It is short, cylindrical, with blunt ends, very stout, th or four times as large as the oviduct, with retractor muscle, and deferens at its apex.

Helix Pennsylvanica, Green. (*Mesodon.*)

The upper portions of the genital system (pl. V, fig. VII) not observ The penis sac (5) is long and slender, with the vas deferens (7) and retrac muscle (6) entering its apex, and its orifice entering the vagina near base. The genital bladder (9) is long, stout, cylindrical, with a medi contraction; its duct (16) is hardly distinct from it, with an entra opposite that of the penis sac. The prostate (4) is very large.

Helix clausa, Say. (*Mesodon.*)

Ohio.

Pl. V, fig. IV. The penis sac (5) is the conspicuous feature of the syste it is longer than the oviduct, and almost as stout, of about equal si throughout; it has the entrance of the vas deferens (7) and retract muscle (6) at its blunt apex. The genital bladder (9) is small, lengt ened oval, with a long, slender duct (16). The prostate (4) is narro stout, prominent, cord like. The vas deferens (7) is large. The oth organs present no peculiar features.

Helix Traski, Newc. (*Arionta.*)

Specimens from the mouth of San Tomas River, Lower California, collected by Mr. Henry Hemphill.

The genital system resembles very nearly that which I have figured of *Helix Nickliniana*, Lea (Proc. Phila. Acad. Nat. Sci. 1874, 41, pl. iv. fig. III). The duct of the genital bladder in this species is, however, very much longer, its accessory duct shorter in proportion, the flagellum of the penis sac longer. There is also a peculiar feature in the genitalia of *H. Traski*, a globular organ of about equal diameter with the vaginal prostate, attached laterally to the flagellum of the latter, before it becomes bifurcated. The bulbous expansions on the two branches of the flagellum are also much larger in *H. Traski.* It is figured in pl. VI, fig. IV.

Helix Stearnsiana, Gabb. (*Arionta?*)

To the kindness of Mr. Henry Hemphill I am indebted for living specimens of this species from Todos Santos Island and the mouth of the San Tomas River, Lower California. The result of the examination of the genitalia and lingual dentition establishes its specific distinction from the Catalina Island form (*H. Kelletti*, Forbes) to which it is nearly related by the characters of its shell. (See L. and F. W. Shells N. A., I, 176, 177).

The genitalia (pl. VI, fig. II) resemble very nearly those of *H. Kelletti* (Proc. Phila. Acad. Nat. Sci. 1874, pl. iii, fig. 4, p. 39).

A comparison of the figures, however, will show considerable difference, especially in the dart sac (14). In the species before me there is a long thread like duct (14^d) leading from the base of the dart sac (14) to a large globular organ, whose character is unknown to me. Opposite the entrance of this duct a corresponding duct (14^e) branches out, but instead of ending in a globular organ it becomes much enlarged in size and ends in enveloping the prepuce (12). The dart sac (14) contained a small dart of the form figured by Leidy (Terr. Moll. U. S., I) for *Tebennophorus Caroliniensis.*

The oviduct was closely and spirally wound around the duct of the genital bladder. The testicle (1) and ovary (11) are yellow.

The jaw is thick, arched, ends blunt, but little attenuated; anterior surface with six stout, separated ribs denticulating either margin, and several less developed, interstitial ribs.

The lingual membrane is long and narrow with about 50–1–50 teeth. The centrals are of the form of those of *H. Californiensis* (L. and F. W. Shells N. A., I, fig. 297). The cusp with its cutting point, however, is very much shorter, reaching only about half-way to the lower edge base of attachment. Laterals of same type. Marginals low, wide variable in the denticles, but usually with one long, broad, sharpl inner denticle (the inner point much the smaller), and one short rarely bifid outer denticle.

The Catalina Island *H. Kelletti* has same type of dentition. The ginals, however, seem much more broadly denticulated.

Strophia iostoma, Pfr.

Inagua, Bahamas.

Jaw strongly arched, ends but little attenuated, bluntly rounded. terior surface without ribs. Cutting edge with a decided, blunt, me projection.

Lingual membrane (pl. II, fig. VIII) long and narrow. Teeth a 29-1-29. Centrals but little longer than broad, tricuspid, the middle short and stout, with a short, bluntly rounded cutting point; side c slightly produced, with a short, sharp point. Lateral teeth like the trals but bicuspid. Marginal teeth a simple modification of the late with one short, bluntly pointed inner cusp, and one still shorter, blu pointed outer cusp. Fig. *a* represents the central and lateral teeth, marginal tooth, *c* an extreme marginal.

Geomalacus maculosus, Allm.

England. Mr. J. Gwyn Jeffreys.

The genital system is figured on pl. V, fig. x. For a description o and of the jaw and dentition, see Ann. Lyc. Nat. Hist. N. Y., X, 308. there stated, the vas deferens is conspicuous by its great length, and penis sac has attached to its apex a singular globular organ, which i conspicuous feature of the system.

Pallifera Wetherbyi, n. sp.

From near the mouth of Laurel River, Whitley C Kentucky, Mr. A. G. Wetherby collected many specim of what appeared to be a small species of *Tebennophor* It was readily distinguished from the numerous young *T. Caroliniensis* found in the vicinity by the arrangem of the blotches of color, they being in irregular, interrupt transverse bands, instead of running longitudinally as that species. The anterior portion of the body seemed a to be more swollen, and the posterior extremity to ta more rapidly than in *Caroliniensis*. On examining the j

I found it to be ribbed, a character placing the slug in the genus *Pallifera*. The presence of ribs was verified in four individuals. Small specimens of *T. Caroliniensis* from the same locality had the usual ribless jaw of *Tebennophorus*. It appears, therefore, that the slug must be considered a new species of *Pallifera*.* It may be called after its discoverer. It is difficult to draw more satisfactory specific characters from specimens preserved in alcohol. One of them in its contracted state measures 12 millimetres in length.

Jaw (pl. II, fig. I) arcuate, ends blunt, but little attenuated; anterior surface with decided, separated, unequal ribs, denticulating either margin, about 15 on one specimen, those at the ends being less developed than on the balance of the jaw; cutting edge with a decided, short, blunt, median projection.

Lingual membrane (pl. II, fig. II) long and narrow. Teeth about 35-1-35. Centrals long, expanding towards the base, cusp stout, with a stout blunt cutting point not reaching the lower margin of the base of attachment, side cusps obsolete. Laterals same as centrals, but unsymmetrical. Marginals (*b*) low, wide, with one inner, long, oblique, blunt cusp, and one outer, short, usually bluntly bifid cusp.

Bulimus foveolatus, Rve. (*Orphnus.*)

Northern Peru. Prof. Orton.

This and the other species collected by Prof. Orton were determined by Mr. Bland.

Jaw slightly arched, wide, low, thin, with over 50 delicate ribs of the kind herewith described under *Bulimulus Lobbi*: ends but slightly attenuated, blunt.

Lingual membrane (pl. I, fig. III) long and narrow, composed of very numerous rows of about 34-1-34 teeth each. Teeth as usual in the *Helicidæ*. The centrals (*a*) with one short cusp, the side cusps being obsolete, cutting point short, bluntly pointed. Laterals like the centrals, but unsymmetrical, and with a more developed outer side cusp. Marginals *b*, a simple modification of the laterals, smaller, higher than wide, with the cutting point longer. The plate gives one central with its adjacent lateral, *a*, and three extreme marginals, *b*.

The membrane is very thick and strong, and of equal width throughout its length, the ends being bluntly truncated.

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* Its dentition is more related to *Tebennophorus* than to *Pallifera* by the absence of side cusps and cutting points to the central and lateral teeth.

The genus *Bulimus* seems to be characterized by
teeth to its lingual membrane of the same type as the
being simply a modification of the latter. Thus far w
the deutition of the following species: *B. porphyr*
scarabus, *odontostomus*, *glaber*, *auris-sileni*, *multicol*
gius, *oblongus*, *ovatus*, *magnificus*, *Hanleyi*, *mar*
and *aulacostylus*. *B. auris-sciuri* (which appears to b
of *B. glaber*), figured by Guppy and Hogg, may no
with these, but the figure is too bad to judge from.

Bulimus auris-sileni, Born. (*Pelecychilus.*)

St. Vincent.

For description of jaw and lingual dentition, see Ann. Lyc. N
N. Y., X, 222. For figure of latter, see Proc. Phila. Acad. Nat. S
pl. vi, fig. 4.

The genitalia are figured at natural size as they appear suspe
water. The whole system is very long and slender. The testicl
embedded in the upper lobe of the liver; it is composed of lon
The epididymis (2) is convoluted along the half nearer the oviduc
accessory gland (3) is composed of prominent aciniform cæc
ovary (11) is short and stout, much broader than the oviduct, lo
The oviduct (8) is long, narrow, greatly convoluted. The vagina
very narrow. The external orifice is behind the right eyepeduncl
penis sac (5) is the most prominent organ. It is extremely long,
ing the length of the whole system. It is tubular, of about equal
along three-fourths of its course, where it receives the vas defer
and commences to taper gradually towards the apex, merging
long, delicate flagellum or lengthened retractor muscle, said muscl
attached to the end. The penis sac does not appear actually to e
vagina; the two organs terminating side by side.

The genital bladder (9) is small, globular, its duct (16) is al
long as the oviduct, of very unequal breadth. For two-fifths of its
beyond the bladder it is delicate, then rapidly expands into a
wide as the ovary, then, tapering, becomes again narrow at th
mencement of the last fifth of its course, but again widely expands
entering the vagina at the upper third of the length of the latter
Pl. IV, fig. v.

Bulimus glaber, Gmel. (*Pelecychilus.*)

Island of Grenada.

Jaw as in *Bulimulus*, *Cylindrella*, etc.

Lingual membrane long and narrow. Teeth as usual in the
long and narrow, centrals tricuspid, laterals bicuspid, marginals

modification of the laterals, with one large, long, inner, pointed cusp, and two outer, small points. See Proc. Phil. Acad. Nat. Sc., 1874, pl. vi, fig. 6.

Cylindrella sanguinea, Pfr.

Jamaica.

The genital system (pl. II, fig. VII), as would be inferred from the shape of the shell, is very much lengthened in all its organs. The testicle (1) is in a globular mass lying close to the oviduct. The epididymis (2) is short. The oviduct (8) is very long and narrow. The vagina is two-thirds the length of the oviduct, it is narrow, with a bulbous expansion at the insertion of the duct of the genital bladder, above its centre. The genital bladder (9) is very small, globular, on a very narrow, long duct (16), which expands at its entrance into the vagina. The penis sac (5) is short, thick as the oviduct, bluntly terminating above, where the vas deferens (7) and retractor muscle (6) are inserted. The ovary (11) is short and stout.

Cylindrella brevis, Pfr.

Jamaica.

The genitalia have the same arrangement as in *C. sanguinea*, herewith described. The duct of the genital bladder (16) in this species is much more expanded before it enters the vagina, and the latter organ below the junction is expanded to a greater size than the oviduct. The penis sac (5) is shorter and stouter in *brevis* than in *sanguinea*. Pl. II, fig. III.

Bulimulus Altoperuvianus, Rve. (*Drymæus.*)

Between Balsas and Cajamarca, Peru, Prof. Orton.

Genitalia (pl. I, fig. II) of the same general form as I have herewith described for those of *Bulimulus Lobbi*. The ovary (11) is smaller in proportion, the oviduct (8) more developed. The duct of the genital bladder (16) enters lower down upon the vagina. The testicle (1) is farther removed from the ovary, lying in the apex of the shell. It is composed of short, stout, blunt cæca. The ovary is of a dark slate color, the rest of the genital system is white. The external orifice is behind the right eye peduncle. The edges of the ovary are very deeply scalloped.

The jaw has thirty-one ribs. It is of same type as that herewith described of *Bul. Lobbi*. Lingual membrane (pl. I, fig. IV) of same type as herewith described and figured for *Bul. Lobbi* as far as centrals and laterals (*a*) are concerned. The marginal teeth, however, are quite different from those of that species. They are quite like the laterals, excepting that the cutting point is very much more produced, and somewhat curved towards the central line of the membrane.

These peculiar marginal teeth remind one of those of *Helix Ghiesbreghti* as figured by Messrs. Fischer and Crosse. In that species, however, the notch is on the outer, not the inner, side of the cutting point.

It will be noticed that the cutting point on the central tooth *Altoperuvianus* is more produced than in *B. Lobbi*, to which I hav pared the dentition.

Bulimulus Peruvianus, Brug. (*Plectostylus.*)

Talcahuana, Peru. Museum of Comparative Zoc Cambridge.

Jaw and lingual dentition already described by me. (Proc. A Sc. Phila., 1874, 53, pl. V, fig. 2.)

The genital system is figured on pl. I, fig. VIII. The testicle extremely large, apparently composed of aciniform cæca. The ymis (2) is long, very thick, and greatly convoluted in its whole c The ovary (11) is long and slender. The oviduct (8) is long and n The vagina is short. The short duct (16) of the genital bladd enters at its upper end. The genital bladder is very stout, alm thick as the oviduct, tapering above gradually to a long flagellate The penis sac (5) enters the vagina near its lower end. It is smalle the genital bladder, cylindrical, tapering gradually towards the where it has a flagellate appendix, into the end of which, perh inserted the retractor muscle. The vas deferens enters the penis sa upper end. The external orifice of the generative organs is behi right eyepeduncle.

Bulimulus Lobbi, Rve. (*Drymæus.*)

Between Balsas and Cajamarca. Prof. Orton.

The genital system is quite similar to that which I have figured *Altoperuvianus* (pl. I, fig. II), the ovary (11), however, is much than in that species. The testicle (1) is composed of short, blunt it lies near the ovary. The epididymis (2) is short. The acce gland (3) is composed of several long, threadlike cæca. The ov long, equalling one-third of the oviduct, and twice as broad. The o (8) is long, convoluted, narrow, with deeply scalloped edges. The v is short, tubular, receiving the duct of the genital bladder near its and the opening of the penis sac just above its base; between the there is a short decided expansion of the vagina. The penis sac long and slender, with a long, flagellate extension, on the end of the retractor muscle (6) is attached. The vas deferens (7) enter penis sac at about the middle of its length. The genital bladder small, globular, on a delicate duct (16) equalling in length the vagin oviduct combined. The external orifice of generation is behind the eyepeduncle.

The jaw (pl. I, fig. VI) is arcuate, with attenuated, blunt ends, transparent, of the same type as is common to *Bulimulus*, *Cylind* *Amphibulima*, *Gæotis*, etc., *i. e.*, with narrow, distant ribs, runnin liquely towards the median line, so that those of the centre converge before reaching the bottom of the plate. These ribs serrate the upper and lower margins. They increase in thickness gradually on their outer edge. There are twenty-one ribs on the specimen examined. The material of the jaw is so thin on the outer edge of the ribs that it separates into distinct plates at these points, when macerated. In some specimens examined the ribs appear to be formed by an actual overlapping of distinct plates. I have no doubt, however, of the jaw being in one single piece, divided by these delicate ribs into numerous plate-like compartments. It is not composite as formerly believed by most authors.

The lingual membrane (pl. I, fig. 1) is broad, very delicate in texture and difficult to handle. There are numerous rows of about 90–1–90 teeth each. The centrals have a base of attachment longer than wide, with lower lateral expansions. The reflection has one stout median cusp, the side cusps being obsolete; this cusp bears a short, rapidly attenuated, sharp cutting point, not reaching the lower margin of the base of attachment. The laterals are of same type as centrals, but unsymmetrical, the cutting point, however, is very different from that of the centrals, being very broad, bluntly rounded at its end, oblique, extending far below the base of attachment, and having on its inner margin, near the blunt end, a prominent blunt notch. The marginals are a modification of the laterals, but lower, with a much more oblique cusp, bearing a much broader trifid cutting point, the middle division very much more produced than the outer ones.

The figures represent *a* one central with its adjacent lateral teeth, and *b*, two marginal teeth.

The lateral teeth are a modification of the usual *Helicidæ* type not before observed by me. The marginal teeth are somewhat like those seen in many species of *Bulimulus*, such as *laticinctus*, *Bahamensis*, *auris-leporis*, *papyraceus*, *Jonasi*, *membranaceus*. They only approach, however, the teeth of those species in form.

Bulimulus rhodolarynx, Rve. (*Scutalus.*)

Northern Peru. Prof. Orton.

The genital organs were so reduced as to be only threadlike, and not sufficiently developed to be described as perfect.

The jaw was not examined, being of so delicate texture as to be quite destroyed by the action of potash.

The lingual membrane is long, narrow. Teeth about 40–1–40, of the usual type of *Helicinæ* (see pl. I, fig. v). The central teeth, *a*, have one median cusp, the outer cusps being obsolete, the cutting point is short and bluntly pointed. Lateral teeth same as centrals, unsymmetrical, the inner subobsolete cusp more developed. The marginals (b) are simple modifications of the laterals, subquadrate, bicuspid, each cusp with a long, oblique, stout cutting point.

From this description it will be seen that *Bulimulu* *dolarynx* has the type of dentition which appears norı the *Helicinæ*, in this respect agreeing with *B. cinnan* *lineatus*, *pallidior*, *chrysalis*, *Guadalupensis*, *alternatu* *radicus*, *dealbatus*, *solutus*, *sepulcralis*, *durus* and *Peruv* For the species differing from the common type of *He* dentition, see remarks under *B. Lobbi*.

Bulimulus Proteus, Brod. (*Scutalus.*)

Northern Peru. Prof. Orton.

Genitalia quite like those described and figured of *Bul. Altoperı* (pl. I, fig. II). All the organs were delicate, almost threadlike, a so well developed as in the species to which I have compared Orifice behind right eyepeduncle.

Jaw, with 28 ribs, of same type as herewith described for *B. Lob*

Lingual membrane of same type as *Bul. Altoperuvianus*, herewi cribed.

Bulimulus primularis, Rve. (*Mesembrinus.*)

Northern Peru. Prof. Orton.

The genitalia are like those of *Bul. Proteus* herein described, b ovary is orange colored.

The jaw was imperfect and thus the number of ribs cannot be It is of the same type, however, as herewith described of *Bul.*

The lingual membrane (pl. I, fig. VII) is broad. Central teeth oı type also as in *Bul. Lobbi*, but much shorter and stouter. The teeth of *Bul. Lobbi* and *B. Altoperuvianus* are wanting in this sı their place being entirely filled by marginal teeth of the form kno *Bul. laticinctus* (see Ann. Lyc. N. H. of N. Y. x, pl. I). The tee subquadrate, with a very large, curved, obliquely trifid cutting extending far below the lower margin of the base of attachment.

Fig. *a* gives one central tooth with the two adjacent ginals; fig. *b* an extreme marginal. The latter will be to be rather narrower than those nearer the median li the membrane.

Orthalicus obductus, Shuttl.

Islands in Bay of Panama, Mr. McNiel.

Jaw as usual in the genus. Lingual membrane (pl. VI, fig. III) as in the genus. Teeth about 96-1-96. The side spurs to the cusps resenting the side cusps of the usual *Helicinæ* type) are not present on the first laterals, but are conspicuous on those farther removed, as shown in figure *b* of the seventh lateral tooth.

Orthalicus gallina-sultana, Chemn.

Marañon, Peru. Prof. Orton.

An opportunity having been given me by the kindness of my friend, Mr. Thomas Bland, of examining the animal of *Orthalicus gallina-sultana*, Chemn., I here give descriptions of its genital system and lingual dentition. It will be seen that my figures of the latter do not agree with those published by Troschel (Arch. für Nat., 1849, pl. iv, fig. 3), at least so far as centrals and laterals are concerned, these teeth not being represented in Troschel's plate. It must be borne in mind, however, that at that early date, the membranes were not so carefully studied as at present, and consequently the peculiarity of these teeth may have been overlooked by Troschel. Of the identity of the specimen examined by me, there can be no doubt.

The jaw (pl. IV, fig. E) is of the type usual in *Orthalicus* and *Liguus*, but up to the present time never observed in any other genus. It is composite, its separate plates being apparently soldered firmly at their upper portions, where, indeed, they seem collectively to form a jaw in a single piece as in *Helix*, etc., but at their lower portion positively detached and free, imbricated one upon another. The jaw may in one sense be said to be in a single piece, as argued recently by Messrs. Fischer and Crosse, (Moll. Mex. et Guat.), but with equal correctness it may surely be said to be composite, as the amalgamation of the upper portion is produced by the joining of absolutely separate pieces. There are fifteen of these plates, the three upper central ones apparently lying upon the fourth, which is very broad and extends from the upper to the lower margin of the jaw. The jaw is strongly arched, with attenuated, blunt ends. There are well marked perpendicular grooves upon the anterior surface of many of the plates.

The lingual membrane (pl. IV, fig. A–C) is very broad (18 mill.), for its length (16 mill.). The rows of teeth are arranged in a backward curve from the median line for a short distance, and then run obliquely to the outer margin of the membrane. The central teeth have a long and rather narrow base of attachment, squarely truncated at the top, incurved with slight lateral expansions at the base. The reflected portion bears one stout, median cusp, the side cusps being subobsolete. This cusp bears a

long, stout, lance-like cutting point, extending below the b
ment to a sharp point, and bearing at the centre of its lengt
a prominent, subobsolete, blunt spur. There are three la
the same type as the centrals, but made unsymmetrical b
sion of the inner lower lateral expansion to the base of att
the inner subobsolete lateral spur to the cutting point. Th
from the central tooth changes suddenly into a marginal too
common in *Orthalicus*, *i.e.*, a long, stout, subquadrate base
with fringed lower margin, bearing at its lower portion, a
rounded subobsolete cusp, from which springs a short, wid
broad, bluntly rounded, gouge shaped cutting point, whicl
outer, lateral spur of the same bluntly rounded form. This
ginal teeth runs quite to the edge of the membrane, tho
outer edge being smaller, more widely separated, and in mo
more widely separated rows.

Fig. A gives a central tooth with adjacent teeth to the
one side, and only one lateral on the other side; fig. C giv
tooth; fig. D two extreme marginals; fig. B an extreme
profile.

The count of the teeth in one transverse row is over 108-

Peculiar as this form of dentition seems, it has already b
***Liguus virgineus.* (See Am. Journ. Conch., VI, 209, fig. 3,**
pl. III). That species differs widely, however, in the less
membrane (10 × 4½ mill.), the smaller count of the teet
in having but two well marked laterals. That species als
teeth intermediate between the laterals and marginals whicl
on different parts of the membrane.

This form of dentition is very instructive in s
modification of the type usual to the *Helicinæ.*
teeth may be said to be obsoletely tricuspid, a
spurs to the greatly produced cutting point are b
cation of the usual cutting points on the side c
Helicinæ. The lateral teeth are in the same way
fication of the usual bicuspid laterals of the *Heli*
marginal teeth are more abnormal in form, but th
but modified from the laterals by the expansi
rounding and shortening of the cusps, and by the
expansion, shortening and bluntly rounding of
points. In *Orthalicus iostomus*, *melanochilus*, *u*
Liguus fasciatus, this process of suppressing
decided cusps and cutting points is extended eq
central and lateral teeth. Other species show the

rant form of centrals and laterals, as *Bulimulus aurisleporis*, (Mal. Blatt., XV, pl. v, fig. 8). In less degree are the laterals modified from the usual *Helicinæ* type in *Simpulopsis sulculosa* (*ib.* fig. 10) as to the cutting points, and in the same particular in *Bulimus Peruvianus* (Proc. Ac. Nat. Sc. Phila., 1874, pl. v, fig. 2). No doubt future research will bring to light a complete series of teeth in land shells, showing a gradual modification in different directions of the normal tricuspid and bicuspid type.

There seem no peculiar characters to the respiratory, digestive and nervous system of the animal. The genitalia are figured on plate IV, fig. F. The external orifice is behind the right eyepeduncle. The testicle (1) is as usual in the *Helicinæ* embedded in the lobe of the liver occupying the extreme apex of the spire of the shell; it is composed of fasciculi of short, stout, blunt cæca. The epididymis (2) is short, convoluted as usual. The accessory gland (3) is on a short threadlike peduncle. The ovary (11) is very large, tongue shaped, lobulated above and decidedly spongelike in its division on its concave side. The oviduct (8) is long, narrow, convoluted. The genital bladder (9) is large and oval, on a long duct (16) which in its natural position is adherent to the oviduct in its entire length: it is much larger in its lower third, equalling the stout vagina, near whose middle it enters; below this point the vagina becomes very stout. The penis is cylindrical, about as long as the vagina, tapering rather abruptly to its apex, where is inserted a long, delicate, retractor muscle (6), which resembles a flagellum. The vas deferens (7) enters the penis on its side, near its summit. There are no accessory organs. The penis (5) does not appear to enter a common duct of male and female organs, but to have a separate opening of its own.

The general arrangement of the genitalia is like that of *O. undatus*, (see this paper), *O. longus* and *iostomus* (Fischer and Crosse), *Liguus fasciatus* (Leidy), and *L. virgineus*, see below. The last four, however, have a single multifid vesicle, which I failed to detect in *O. gallina-sultana;* and from them all there is ample specific difference in the size of the ovary, the shape and size of the penis sac, and the size of the duct of the genital bladder, near its base.

It may fairly be assumed that no generic difference exists between the genitalia of *Orthalicus* and *Liguus.*

These remarks are suggested by the treatment of *Liguus fasciatus* by Messrs. Fischer and Crosse (Moll. Mex. et Guat.). On account of the resemblance in dentition to the species of *Orthalicus* known to them rather than to the allied *Liguus virgineus*, these authors place *Ligu* in *Orthalicus*, under the subgeneric name of *O* The same reasoning will now oblige them to pl *licus gallina-sultana* in the genus *Liguus*, for it resembles that of *L. virgineus* and not that of known species of *Orthalicus*. It appears to me n to wait till more is known of the dentition of before we consider the teeth as reliable generic

Orthalicus undatus, Brug.

It will be interesting in connection with my of *Orthalicus* and *Liguus* to state that having ha tunity of dissecting six specimens of this sp Jamaica, I found the genitalia constantly agr Lehmann's fig. in Malak., Blatt., 1864, pl. i, fig. 4 no multifid vesicle on the penis as in the species *icus* figured by Fischer and Crosse (Moll. Mex.). exception, the genitalia are quite like those figure for *Liguus fasciatus* (Terr. Moll. U. S. I. pl. v).

It will be seen above that *Orthalicus gallina-sul* characterized by the want of the multifid vesicle.

Liguus virgineus, Lin.

Aux Cayes, Haiti. Mr. Robert Swift.

In connection with my friend, Mr. Thomas Bl already described the jaw (L. and F. W. Shells I 312, fig. 364) and lingual membrane (Am. Journ. 209, figs. 3,4) of this species. The membrane havi still more interesting from its resemblance in son to that of *Orthalicus gallina-sultana*, Chemn., lately I have given the accompanying more detailed il (pl. III).

There is, it appears, considerable variation in the develo cutting points of the central and lateral teeth, and the cus marginals, on different parts of the membrane. Fig. D is ta most perfect portion of the membrane, the most anterior p

A is taken from the least developed, or posterior end of the membrane. Figs. B and C are drawn from intermediate points, the former from near the centre.

Marginal teeth from various points of the membrane are figured in E and G, each tooth being numbered from the median line. Fig. F shows an extreme marginal in profile.

Near the outer edges of the membrane the teeth are not only much smaller, and arranged more obliquely, but they are more separated from each other on the same transverse row, and the rows themselves are not so crowded together as in the portions of the membrane nearer the centre.

On dissecting the animal I found nothing of peculiar interest in the digestive, respiratory or nervous systems. There appeared to be the same general arrangement as figured by Dr. Leidy (Terr. Moll. U. S., I, pl. v) for the allied species, *L. fasciatus.* The same may be said of the generative organs, which, however, I have figured (pl. IV, fig. G) to compare with the figure I have given of the same organs in *Orthalicus gallinasultana.* The external orifice of generation is close behind the right eyepeduncle. The testicle, epididymis and ovary were separated from the specimen examined. The oviduct (8) is long, narrow, greatly convoluted. The genital bladder (9) is small and globose; its duct (16) is long and narrow; in its natural position it lies close against the oviduct: as the duct joins the vagina it becomes enlarged to the size of the latter which it enters at its upper third. The vagina is very wide below this junction. The vas deferens (7) runs as usual along the side of the vagina to its base, and thence to the summit of the penis where it enters. The penis sac (5) is long, slender, cylindrical, narrowing at its apex, into which is inserted a long delicate retractor muscle (6) which might be considered a flagellum: the penis does not seem to enter the vagina, but to have an independent opening of its own. Near its base it bears upon a short pedicle, a single prostate gland, a multifid vesicle of the same type as figured by Dr. Leidy in *L. fasciatus*, composed of about six short, ovate, detached lobes.

Thus it will be seen that *Liguus virgineus* agrees in its genitalia with the allied species, *L. fasciatus*, but differs in its shell, and in its lingual dentition. No generic value can be placed upon this last character, however, for while *L. fasciatus* resembles in its dentition *Orthalicus undatus*, *melanochilus*, and *iostomus*, its allied species *L. virgineus* is characterized by a widely different dentition, which is shared on the other hand in a great measure by *Orthalicus gallinasultana*. From our present knowledge we are forced to believe that lingual dentition will furnish no guide to the generic distinction between *Orthalicus* and *Liguus*.

The tail of the animal is very long and pointed. is no distinct locomotive disk to the foot.

Succinea obliqua, Say.

A specimen from New York, received from Dr. Lewis, furnished the jaw and lingual membrane h scribed.

Jaw of shape usual in the genus, with the quadrate accesso Cutting edge with a prominent median projection. Anterior surf decided stout ribs denticulating the cutting edge; one speci three broad and two intervening narrow ribs: another speci seven ribs.

Lingual membrane long and narrow. Teeth about 48-1-48. subquadrate, tricuspid, the middle cusp long and stout. Latera than wide, bicuspid, the third, inner cusp being only rudi Marginals a modification of the laterals, with one long, slend cusp, and two short, slender outer cusps. The cusps of all t bear sharp cutting points.

In Terrestrial Mollusks of United States, vol. I, fig. 3, a jaw is figured as that of *Succinea ovalis.* doubt represents rather that of the true *obliqua*, Say, *Succ. ovalis*, Gld. not Say. The jaw of the latter is in L. and F. W. Shells of N. A., I, p. 258. The fi genitalia given by Dr. Leidy on the plate referred rectly represents that of *S. obliqua.*

EXPLANATION OF THE PLATES.

The figures of genitalia all have the same references:

1. The testicle.
2. The epididymis.
3. The accessory gland of the last.
4. The prostate.
5. The sac of the penis.
6. The retractor muscle of the penis.
7. The vas deferens.
8. The oviduct.
9. The genital bladder.
10. The external orifice of the organs.
11. The ovary.
12. The prepuce.

13. The vaginal prostate.
13a. flagellum to same.
13b. accessory gland to same.
13c. accessory duct to same.
13d. same as last with globular organ.
14. The dart sac.
15. The flagellum.
16. The duct of the genital bladder.

In the figures of dentition it will be understood that the general intention is to give (*a*) one central tooth with its adjoining lateral, and (*b*) one or two marginal teeth. The numbers of the teeth refer to their position in counting from the median line of the membrane. This arrangement gives as good an idea of the characters of the dentition as my space will allow.

PLATE I.

FIG.
I. Bulimulus Lobbi, Rve. Dentition; *a*, lateral teeth: *b*, extreme marginal teeth.
II. Bulimulus Altoperuvianus, Rve. Genitalia.
III. Bulimus foveolatus, Rve. *a*, central and lateral teeth: *b*, extreme marginals.
IV. Dentition of II. *b*, extreme marginals.
V. Bulimulus rhodolarynx, Rve. *b*, marginals—first and extreme.
VI. Jaw of I.
VII. Bulimulus primularis, Rve. *b*, extreme marginal tooth.
VIII. Bulimulus Peruvianus, Brug.

PLATE II.

FIG.
I. Pallifera Wetherbyi. Jaw.
II. Same; dentition. *a*, central and lateral teeth: *b*, marginal teeth.
III. Cylindrella brevis, Pfr. Genitalia.
IV. Zonites sculptilis, Bland. Dentition; *b*, extreme marginals.
V. Bulimus auris-sileni, Born. Genitalia.
VI. Helix nucleola, Rang. Genitalia.
VII. Cylindrella sanguinea, Pfr. Genitalia.
VIII. Strophia iostoma, Pfr. Dentition; *a*, central and lateral teeth: *b*, marginal tooth: *c*, extreme marginal tooth.
IX. Helix discolor, Fér. Genitalia.

PLATE III.

FIG.
Lingual dentition of *Liguus virgineus*, Lin.
A. From the least developed end of the membrane. The central tooth with the two lateral teeth and three marginal teeth.
B. From near the centre of the membrane.
C. From near the anterior end of the membrane; portions of two adjacent rows of teeth.
D. From still nearer the anterior end of the membrane.
E. Marginals from the same end of the membrane as the last.
F. Extreme marginal in profile.
G. Extreme marginals.

PLATE IV.

FIG.
A. Lingual dentition of *Orthalicus gallina-sultana*, Chemn.
B. A marginal tooth of the same in profile.
C. The same. The eighth from the median line.
D. The same. Extreme marginal teeth.
E. The same. Jaw.
F. The same. Genitalia.
G. Liguus virgineus, Lin. The genitalia.

PLATE V.

FIG. Genitalia and Dentition of
I. Zonites inornatus, Say.
II. Zonites friabilis.
III. Helix Troostiana, Lea.
IV. Helix clausa, Say.
V. Helix rufo-apicata, Poey.
VI. Dentition of III.
VII. Helix Pennsylvanica, Green.
VIII. Helix nuxdenticulata, Chemn.
IX. Helix Josephinæ, Fér.
X. Geomalacus maculosus, Allm.

PLATE VI.

FIG.
I. *Helix Clarki* Lea. Lingual dentition, *a*, central and lateral tooth;
tooth. See also fig. V for extreme marginals.
II. *Helix Stearnsiana*, Gabb. Genitalia.
III. *Orthalicus obductus*, Shuttl. Lingual dentition; *a*, central and later
the seventh tooth: *c*, extreme marginal teeth.
IV. *Helix Traski*, Lea. A portion of the genital system, showing vaginal
V. See I.
VI. Same as I. Genitalia.
VII. *Helix Wetherbyi*; Bland. Lingual dentition; *a*, central and lateral t
marginal teeth: *c*, extreme marginal teeth.

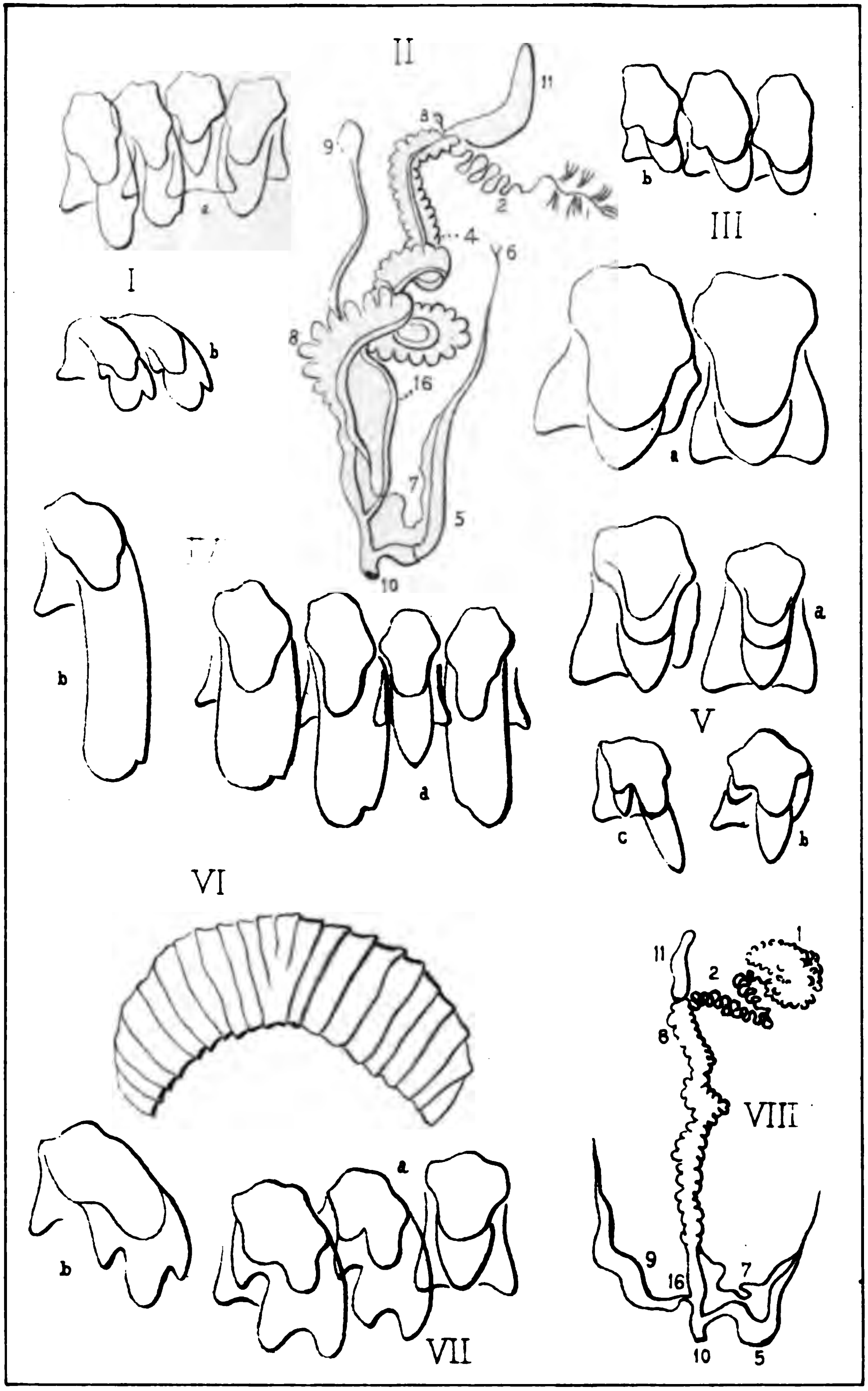
Note on the Jaw of PARTULA.

Having lately received through the kindness of
D. Hartmann a number of *Partula* preserved in al
am preparing a description of their lingual dentitio
talia and jaw. The latter is the most important poi
studied, this organ never having been described,
therefore, give the following particulars:

In *P. fusca*, Pease, *umbilicata*, Pease and *virginea*, Pease, it is
and transparent; arcuate with attenuated ends; cutting margi
broad very slight median prominence; anterior surface with
(over 60 in *virginea*) very delicate, separated ribs, slightly den

either margin, those of the centre converging and meeting before reaching the lower margin, as in *Cylindrella*, &c. The jaw appears therefore to be of the same type as in *Bulimulus*, *Gœotis*, *Amphibulima*, *Cylindrella*, *Macroceramus* and *Pineria*. The ribs, however, are in *Partula* exceedingly fine.

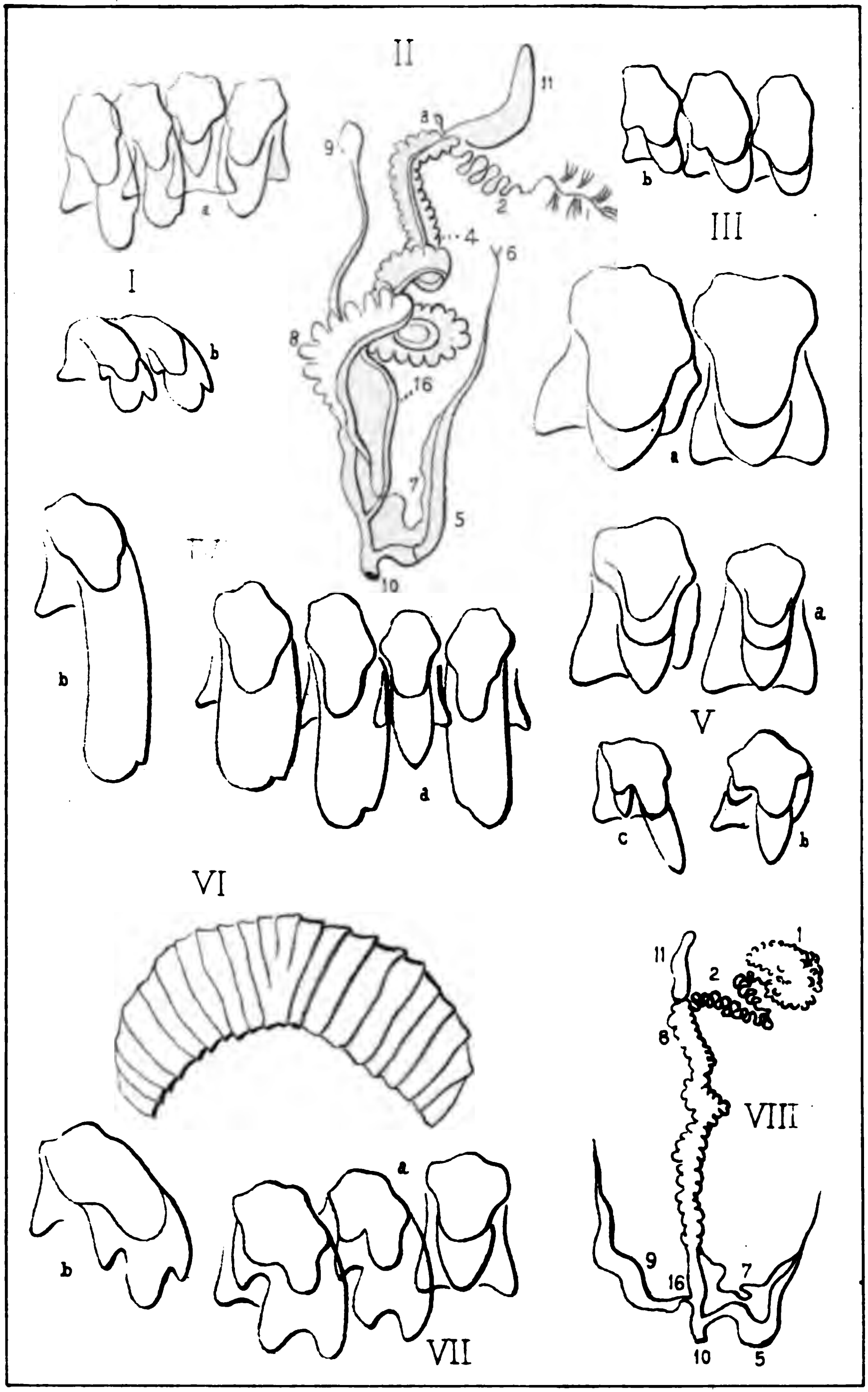
The lingual dentition of the species mentioned above is the same as figured by Heynemann (Mall. Blatt. 1867, pl. i, fig. 1,) excepting that I detect distinct cutting points to the side cusps of the central teeth, not figured by him.



F. Bufford's Sons Lith. Boston.

W.G.B. del.

Ann. of Lyc. Nat. Hist. of N.Y. Vol. XI. Plate I.



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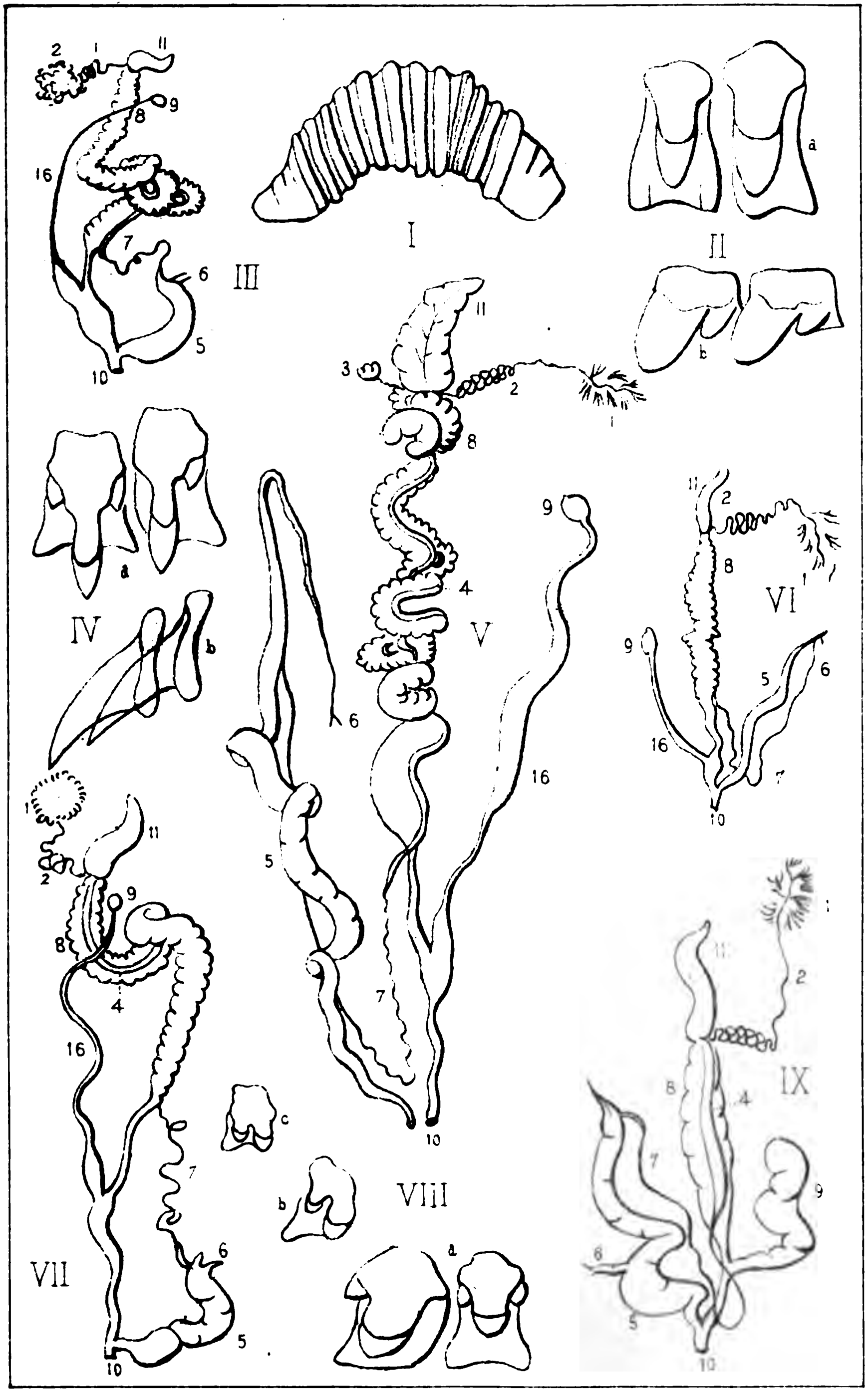

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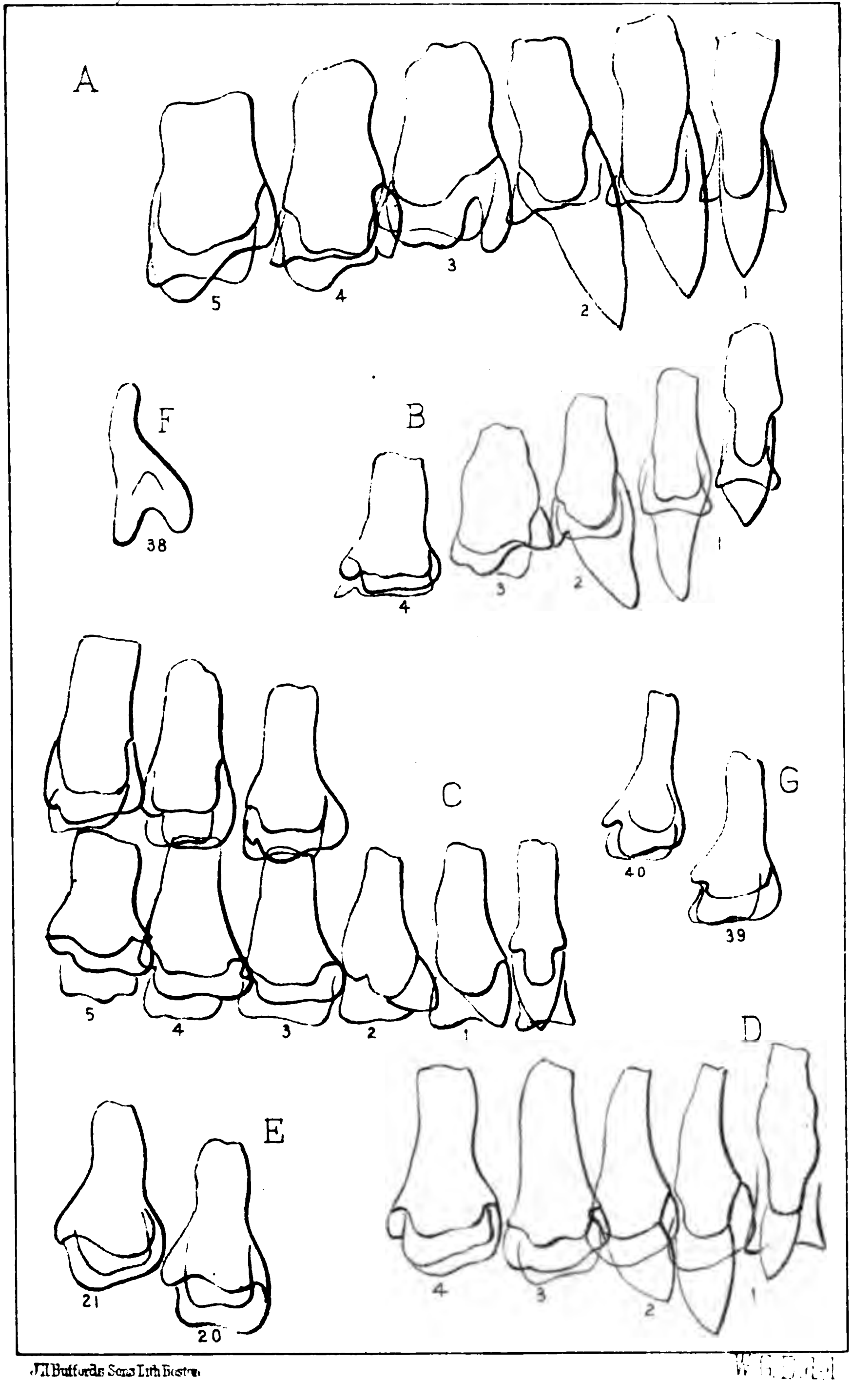

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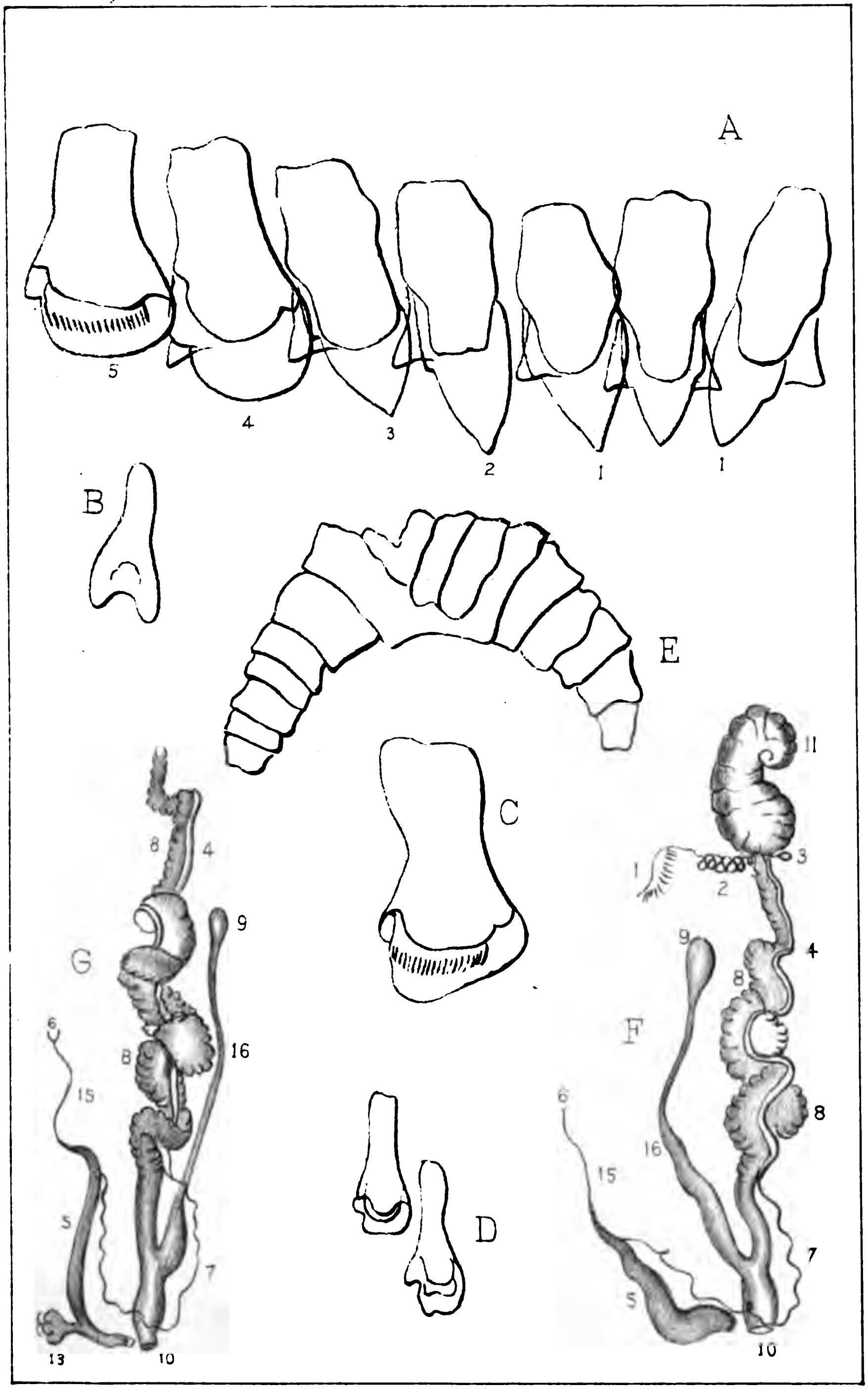

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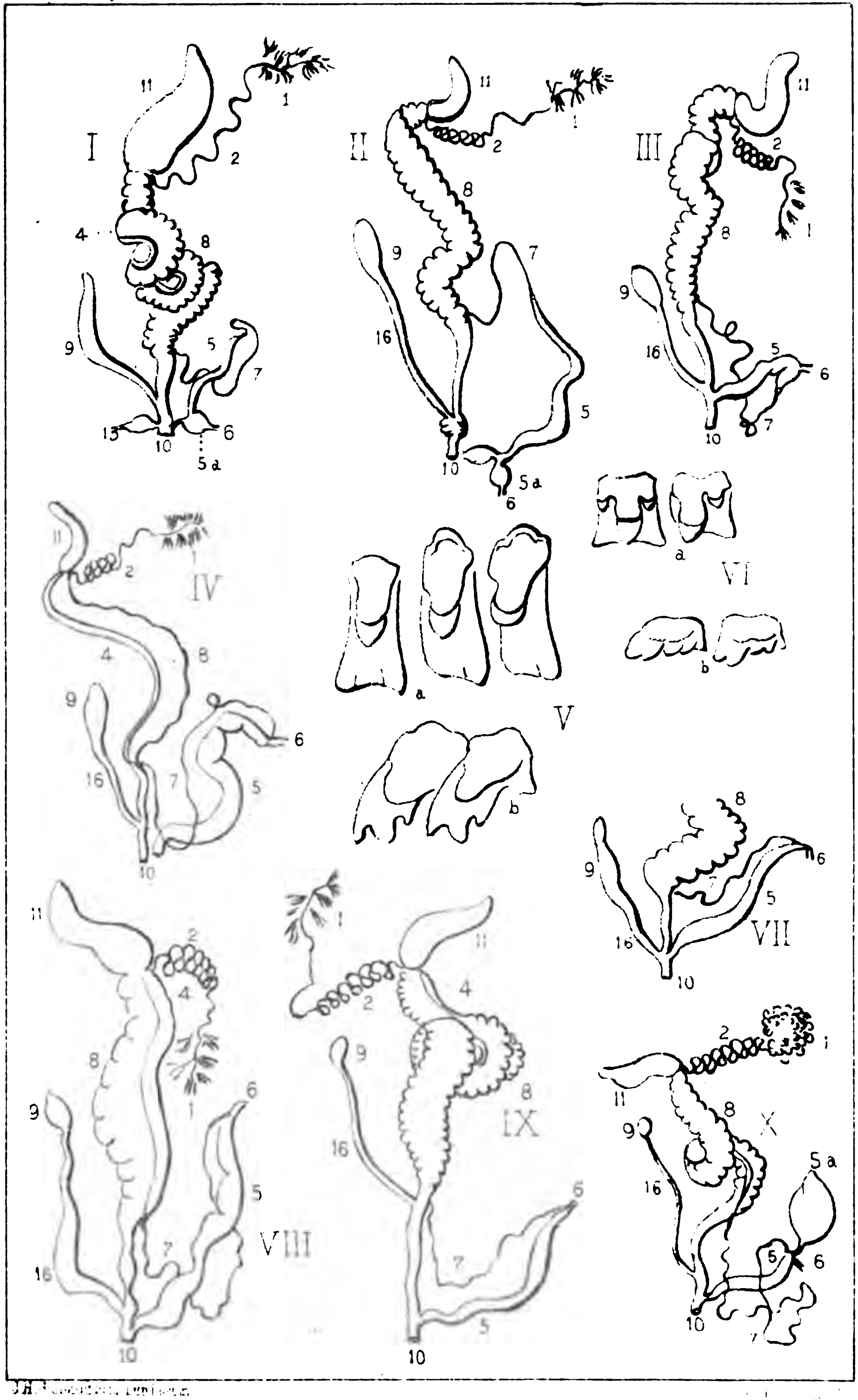
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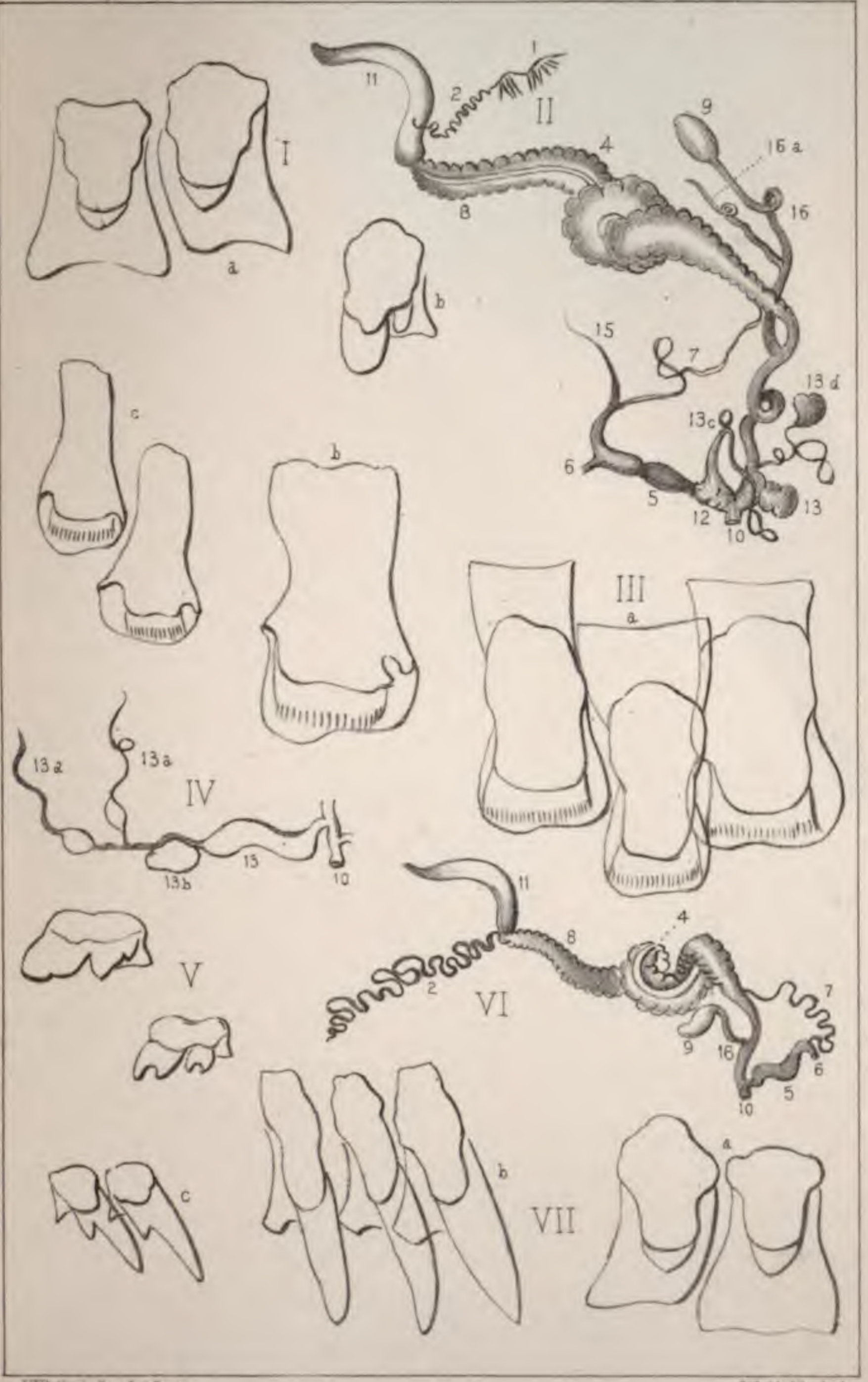

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